ELECTRICAL REVIEW

[ILLUSTRATED.]

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Anticipated.

To the Editor of Electrical Review:

A correspondent of the London *Electrical Review*, Oct. 7, describes a "new system of electrical distribution as follows: "Any number of dynamos are joined up in series, and from each junction, as well as from the main terminals, a main wire is led, these wires being all of equal diameter, etc."

The system proposed is almost identical with the three-wire system of Mr. Edison, who patented the same as applied to a four, five, or a more numerous wire system. It does seem strange that with two cable companies and innumerable lines of steamers, the fact that just such a system in actual use in this country for the past four years should not have been heralded to the scientific public the world over.

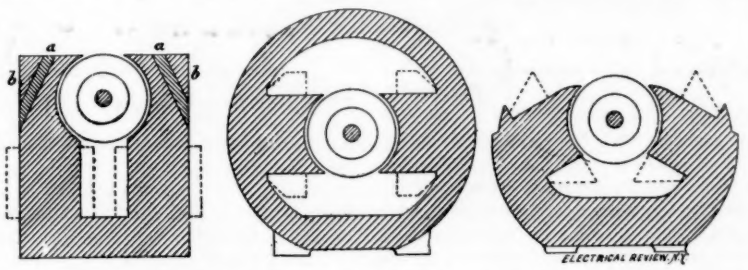
Frank M. Gilley.

Boston, Oct. 25.

Field Magnets for Dynamo Machines and their Comparative Merits.

Although the general principles which should be followed in the construction of dynamo magnets are universally known, and the dimensions and winding for a given output can be determined by calculation with a fair amount of accuracy, there are yet certain details of form and shape which cannot easily be brought within the realm of mathematical investigation, and which nevertheless are of some importance, because influencing the weight and cost of the machine. It is well known that for two-pole continuous current machines, the double horseshoe form has the advantage of lightness as compared with the single horseshoe form; but on the other hand the latter has the advantage of greater economy, both in copper wire and exciting energy, and for this reason it is more largely adopted than the former type. Accepting, then, the single horseshoe as the most practical design generally, the question arises, in which way are the two limbs and the yoke to be arranged in order to secure a maximum output for a minimum of weight. This question has been investigated experimentally in Germany by Herr W. E. Fein, who, it may be remembered, was one of the first to make small dynamos for laboratory use. This investigation has been published in the last issue of our contemporary, the *Centralblatt fur Elektrotechnik*, and as the results obtained appear to be of some practical importance, we give herewith a short summary.

Herr Fein constructed three dynamos, all having the same kind of armature, but different arrangements of field magnets, as shown in the annexed sketches (Figs. 1, 2, and 3), which represent traverse sections through the machines. The exciting coils are shown in dotted lines. The armatures were 10.6 in. diam. and 8.6 in. long. The cores were built up of sheet-iron disks 25 mils. thick, and wound Gramme fashion, so as to contain 288 turns of wire counted all around the circumference. The thickness of the pole pieces in Fig. 1 could be varied by putting on or taking off the slabs *a* and the wedge pieces *b*. A preliminary experiment showed that when the wedges *b* were taken off the electromotive force of the machine rose by 1.5 per cent., whilst the removal of the slabs *a* did not materially alter the performances of the machine. When the pole pieces were further cut down the electromotive force fell, so that the experiments showed that the proportion indicated in the cross-sectioned portion of our sketch—which is a correct representation of the author's drawing, but to a smaller scale—was the best which could have been adopted. The objection to the upright type of magnet is that comparatively large surfaces are exposed on the back of the pole pieces, and a sensible magnetic leakage is thus created. To improve the machine in this respect the arrangement shown in Fig. 2 was next tried. In this case the protruding part of the magnet not serving as polar surface to the armature is reduced to a minimum, and consequently there is very little leakage; but owing to the great length of the yoke its cross section must be considerably larger than in the first design, and therefore the weight of the machine is increased. The arrangement shown in Fig. 3 has a smaller weight than that in Fig. 2, but larger as compared to Fig. 1. In this case the field



Figs. 1, 2 and 3.—Views of Different Forms of Field Magnets.

magnets are inclined to the horizontal, and only one yoke is employed, which forms part of the bed plate. The amount of surface exposed on the back of the poles is not much greater than in Fig. 2, but considerably smaller as compared to Fig. 1, and it is chiefly owing to these circumstances that Herr Fein attributes the good results obtained with this machine. The following table gives some of the constructive data of these machines and the results obtained:

Constructive Data.	Fig. 1.	Fig. 2.	Fig. 3
Weight of complete machine	11.3cwt.	13.3cwt.	12.1cwt.
Cub. in. of iron in armature	400	400	400
Length of armature core	8.6in.	8.6in.	8.6in.
Diameter of armature core	10.6in.	10.6in	10.6in.
Thickness of disks.	25mils.	25mils.	25mils.
Number of disks	265	265	265
Number of turns on armature	288	288	288
Number of commutator plates	48	48	48
Weight of copper wire on armature	16.5lb.	16.5lb.	16.5lb.
Weight of copper wire on magnets.	135lb.	131lb.	132lb.
Total weight of copper	151.5lb.	147.5lb.	148.5lb.
Experimental Data.			
Revolutions per minute	1200	1200	1200
External current	40amp.	44amp.	54amp.
External pressure	110vlts.	122vlts.	131vlts.
External energy.	4400wts.	5368wts.	7074wts.
Efficiency	85%	86.6%	86.5%
Watts per lb. of copper	29	36.2	47.2
Watts per lb. of total weight	3.45	3.57	5.21

An electric light company has been organzed in Sterling, Kas. The capital stock is $12,000. The directors are John K. Skiles, John H. Ricksecker, William C. McVay, Aaron G. Kellar and William Quigley.

Permanent Exhibition at St. Petersburg.

Russia seems to recognize the advantage of keeping pace with the strides of progress of western civilization, in order to properly utilize her vast stores of wealth and opportunities for improvement. We are informed that an enterprise has been instituted under the seal and protection of the Russian government, which should, in fulfilling its aims, also greatly benefit American inventors and our export interests. According to our informant, the Association of Engineers of Ways and Communications, at their own headquarters, St. Petersburg, Fontauka 23, have opened a permanent exhibition for machinery, electrical appliances, samples, drawings, etc., with the special purpose of acquainting Russian railway men, canal and river navigation companies, mine owners, manufacturers, etc., with the latest improvements in American machinery, new products and everything which tends to improve and facilitate the mechanic arts and industrial processes.

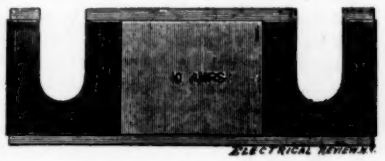
The Russian government also desires to take cognizance of late developments in technical directions, as she intends to herself execute hereafter all the great public works heretofore given out on contract; and will therefore have to make large expenditures for the purchase of plant and machinery, patents, etc.

The United States is the best field from which to draw such supplies, on account of the similarity as to climate, geology, extent of territory, and we are the only country where the great problems of vast systems of railways, canal and river navigation and internal improvement can be profitably studied. It is a satisfaction to see these signs of progress in a nation of such vast resources, and we hope Russia will continue in all things to emulate America, even to the heaven-born deed of emancipation, which has made us the glory of modern civilization.

Mr. A. Warschrawsky, of St. Petersburg, has been entrusted with the general agency for America, and will be glad to furnish all information as to applications for space, shipping directions, patent matters, chances of sales, etc., at his offices, 14 Dey street, New York.

Hedges' Switches and Mica Foils.

Our esteemed London contemporary and namesake says of these: "The vulcanized fiber which supported the contact in these switches has been found to be an objection when the switch was fixed in a damp situation, owing to the moisture causing it to swell and thus interfering with the action of the switch, to say nothing of other obvious objections to the presence of moisture. In the instruments which have been submitted to us the fiber is entirely done away with, and no support at all is required for the contact when in the 'off' position, this being effected by a very simple device. A neat form of spring is also so arranged that it is impossible to leave the switch partly on.



"The accompanying illustration of the new mica foil explains itself, and is decidedly an improvement on the former plan of making the contact through two eyelets, as the slots permit of a new foil being fitted without necessitating the removal of the contact screws. We think that these mica foils will be found quite as handy to use as lead wire, and, according to Mr. Hedges, they do not run into globules when melted as the thin particles of foil stick to the mica, and, therefore, the foils can be used without slate bases."

Among the Electric Motors.

Mr. C. L. Wright is actively pushing the Cleveland Electric Motor. The headquarters of the company is at 406 Broadway.

The Baxter Motor Company, Baltimore, has opened an office at 146 Broadway, New York. Mr. T. C. McCoubray is in charge.

Much interest is evidenced in the new motor of the Eddy Electric Company, Hartford. Arrangements to manufacture on a large scale are being made.

The C. & C. Motor Company is doing a large business in New York city. The sales department of this company has been transferred from the treasurer's office, No. 2 Wall street, to the factory at No. 90 South Fifth avenue. They are now delivering their automatic constant speed motors for incandescent circuits, and their safety (shunt-wound) motors for arc circuits with the new Wheeler regular, the invention of the electrician and superintendent, Mr. S. S. Wheeler. This regulator is arranged to be operated by hand or treadle, and dispenses with shunts or resistance boxes.

* * Mr. C. J. Woodward gives an account of some experiments by which he demonstrated the well-known fact that the combustion of coal gas for illuminating purposes injures the leather bindings of books. Prof. Tilden, of Mason College, thought that in actual experience the injury was much greater than it was in experiments, because of the rise and fall alternately of the temperature when the gas was lighted and extinguished. When the gas was lighted a film of moisture was deposited on the books on the upper shelves, which moisture contained minute quantities of sulphuric acid, and when it evaporated the acid remained. This by degrees accumulated until it destroyed the books.

The Dynamograph.

A Washington correspondent sends the following concerning the electric typewriter:

The instrument in appearance somewhat resembles an ordinary mechanical typewriter. It has a key-board, and the types are placed on steel bars, which play upon a common center, as is the case with the typewriter. The motive power used is electricity, by means of which evenness of action is assured. No matter how heavily or how lightly the keys are struck, the impression on the paper is the same. A remarkable feature of the invention used as a typewriter is that the carriage moves automatically both forward and backward. When the end of the line is reached the carriage returns to the starting point without the aid of the operator, and the paper bar moves one notch, so that all that is required of the operator is to depress the keys. The most important field for the new invention is said to be in connection with the telegraph. It is said at the Patent Office that the instrument can be used both as a transmitter and receiver of intelligence over a single wire, no matter how great the distance may be. The receiving instrument does not require the attendance of an operator, but prints the dispatch automatically. The instruments at both ends of the line print the dispatch sent, and so a safeguard against mistakes is provided. It is claimed that the electric typewriter will be valuable as a local aid to business, and offers many advantages over the telephone. One advantage claimed for it is that, no matter whether a person called up is at his place of business or not, the message can be printed through the medium of his typewriter, and will be there for perusal on his return. The dispatches printed are in letter form, and not an endless tape. The instrument, which has been christened the dynamograph, is considered by patent office officials to be one of the greatest inventions upon which patents have been issued. The electricians do not stint their praise, and are positive that the machine will greatly simplify business intercommunication. Some of the electricians of this city who have seen the instrument, notably Professor Berlinger, of the Bell Telephone Company, state that the dynamograph is destined to take its place as a powerful adjunct to telegraphy, and will be by no means a rival that the telephone can afford to scorn John Russell Young, ex-Minister to China, has taken hold of the new invention, and is president of the company which is to put it in practical operation.

The Brussels Electric Tramway.

An interesting paper on the electric tramway of Brussels has been contributed by Mr. A. Bandsept to the proceedings of the Société des Anciens Elèves des Ecoles Nationales d'Arts et Métiers. The cars on this line are propelled by a motor placed under the floor, and current is supplied by Julien accumulators, which are inserted under the seats from the sides, and not from the end of the car, as in Reckenzaun's arrangement. The battery is divided into sections, and contact springs are fitted which establish the continuity of the circuit by the action of pushing each section in. The grids or supports of the active material in the accumulator plates are cast of an alloy containing 95 parts of lead to 3½ parts of an imony and 1½ parts of mercury. It is claimed for this composition that the grids are very stiff, inoxidizable, and that the surface of the mental insures firm adherence of the filling-in paste. Two batteries are required for each car, so that one may be in service while the other is being charged. During the last five months the regular routine was, to run thirty miles before replacing the battery. The total weight of the car in working, and with its full complement of passengers, is 6 tons. The weight of the battery is 30 cwt., and the 120 cells composing it can be united, 30, 60, 90, or all in series, producing an electromotive force of respectively 60, 120, 180 and 240 volts. These different combinations are produced by a regulating switch, by which the speed of the car is controlled. The electromotor is fixed to the under side of the car floor near one of the axles, and works, by means of rope gear, an intermediate shaft suspended between the two axles of the car. From this countershaft motion is transmitted to one of the axles by a pitch chain. The motor is scarcely powerful enough for the work, but its general arrangement is convenient. The field magnets are compound wound, so as to increase the torque on steep gradients when the current is large. The commutator and brushes present a special feature. There is a double commutator, the sections of one being connected with those sections of the other which are diametrically opposite, so as to bring the positive and negative brushes side by side, and not on opposite sides of the commutator, as generally arranged. There are two sets of brushes so connected that when one pair is on the other pair is off, and by this means the direction of motion is controlled.

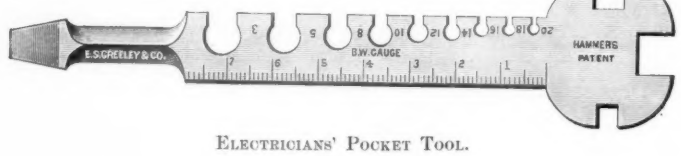
Electricity and Gas to go Hand in Hand.

Marked and substantial progress is being made in all branches of electrical science. Few, especially among holders of gas stocks, will forget the great rage for electric lighting a few years ago, when the first blush of success had crowned the efforts of the early inventors in this line, and how at first many scared people in gas circles impulsively threw overboard their lines of gas securities, believing that the new light gave promise of almost entirely supplanting gas light in the immediate future. This inconsiderate impetuosity of holders of gas securities was quickly recognized and as quickly acted upon by a considerable number of reckless speculators, and furnished the impetus for the promotion of a large number of greatly over-capitalized electric lighting companies, proposing to do all sorts of impossible things Naturally, time, which levels and corrects all things, has brought about a very marked change in the situation. Many of the companies, which came into a hasty existence, have collapsed and their places have been filled by a staunch class of concerns, whose capital is invested in plants that are economically managed, and the business is being carried on, as a rule, in the most legitimate manner. The first failures—always discovered when we look in o the early history of every important invention—have borne their fruit, and a new wave of electrical development has begun. The energy which is displayed by those foremost in the management of electric lighting industries is destined to place the electric light on a safe and sure footing in all sections of the civilized world. American genius and American talent will place domesticated electricity at a profit in all portions of the inhabitable globe. This is giving just credit and honor to whom honor is due. But has this great and rapid development of electricity diminished in any respect the output for illuminating gas ? We do not believe that it has, but on the contrary, the demand for gas has increased during the present decade in excess of the increase that marked the previous ten years before the electric light was thought of as an illuminant commercially. On the whole, we are inclined to believe that gas companies may attribute much of their increased output to the natural demand for more light caused by the brilliant electrics. It is with a true sense of appreciation that we regard the constant tendency of these two interests to harmonize. And we watch with the much concern the lessening of the heretofore wide breach which will in time cement the two in the closest bonds of friendship.—*Progressive Age and Watar Gas Journal.*

——The Hartford, Ct., Electric Light Company is losing no time in getting the ground cleared for its central light station. Workmen are already tearing down the building occupied by the Hartford Cab Company.

A Convenient Pocket Tool for Electrical Workers.

The "Electrician's Pocket Tool," manufactured by E. S. Greeley & Co., New York, is made of the best tool-steel, nickel-plated, and is of the finest workmanship, and can be carried in the vest pocket, a neat case being made for that purpose. The tool, as appears in the cut we publish, comprises Birmingham wire gauge, the French millimeter and English inch comparative scales, screw driver, wire cleaner or pencil sharpener, and standard wrenches. The new tool is meeting with much popularity in electrical circles, and every workman, telephone inspector, etc., should have one.



ELECTRICIANS' POCKET TOOL.

Electric Lighting in Baltimore.

The electric light ordinance, which Mayor Hodges is holding under consideration before giving it his approval, authorizes and directs the mayor, comptroller and register to contract with the Brush Electric Company of Baltimore, or with the United States Power and Light Company of Baltimore, or the Thomson-Houston Electric Company of Baltimore, or any one of them, to light the whole or any part of the streets, lanes, alleys, squares and parks of the city with electric lights, and specifies that the compensation to be paid shall not exceed fifty cents for each lamp each night. It is also specified that the contract or contracts shall continue for five years, with the same provisions now existing with regard to the number of lamps, hours of lighting and extinguishing, etc. The ordinance also authorizes contract with either of the companies at any time hereafter for lighting any other portion or portions of said city whenever it may be deemed for the best interests of the city so to do, upon the application of any considerable number of the property holders or residents of such other portion or portions, and at and for the same rates of compensation which may be agreed upon and set forth in the contract or contracts first herein authorized, such contracts to continue for the period of five years from their respective dates. The contract or contracts first provided for shall be executed within thirty days from the passage of this ordinance, and with that one of the companies offering to perform the contract for the lowest price per lamp per night, not exceeding fifty cents. The bond required is $20,000. All ordinances or parts of ordinances in conflict with any provision of this ordinance are repealed, and this ordinance shall take effect from the date of its passage. It is understood that objection is made to the ordinance for the reason that the limit is made at five years, with five years from date of contract for all the additional contracts, thereby practically intrenching the successful corporation illimitably, and making it impossible for the city to seek elsewhere for such service should the opportunity or occasion present themselves.

Electricity for Power Purposes.

At a recent gathering of electricians there was talk of establishing stations in the coal regions of Pennsylvania and of transmitting electricity by wire for power purposes instead of transporting the coal. It is not improbable that great strides will soon be made in this direction. The suggestion is another form of an idea that was entertained by Siemens, who predicted that the time would come when coal would be converted into gas at the mine at the rate of 40 000 cubic feet per ton, and would be pumped to manufacturing centers, thus doing away with the expensive system of railroad transportation now in vogue.—*Philadelphia Record.*

—— Italy and England are joining France in the movement for lighting all the theaters by electricity, and in Spain also the electric light is being resorted to for securing greater safety in public halls, theaters, etc.

On the Analogy between the Composition of Derivations in a Telegraph Circuit into a Resultant Fault, and the Composition of Gravitation on the Particles of a Rigid Body into a Center of Gravity.

Written for ELECTRICAL REVIEW.

It is shown in works on "Statics" that the sum of the effects of gravitation forces on all the particles of a rigid body at rest, is equivalent to the effect of the sum of those forces acting at a single point in the body, called its center of gravity, whose position, determined by the body's form and density, is invariable, while that form and density remain constant throughout.

For example, if we consider the case of a series of n particles rigidly connected in a straight line, as $A\,B$ in Fig. 1, it can be proved that the distance D of the center of gravity of the line of particles is from A.

$$D=\frac{d_1 g_1 + d_2 g_2 + d_3 g_3 + \ldots\ldots + d_n g_n}{g_1 + g_2 + g_3 + \ldots\ldots + g_n} \quad (1)$$

where g_1, g_2, g_3,....g_n are the respective forces of gravitatation on each particle and consequently are proportional to the mass of each particle, while d_1, d_2, d_3, ... d_n are the respective distances of those particles from A.

The equation is generally expressed more concisely thus:—

$$D = \frac{\Sigma\, d\, g}{\Sigma\, g} \quad (2)$$

where $\Sigma\, d\, g$ stands for the sum of the whole series of products of the type $d_r\ g_r$ and Σg for the sum of the whole series of forces from g_1 to g_n, in other words, $\Sigma\, g$ will be the total weight of the body. It follows algebraically that D will lie between the limits d_1 and d, which is equivalent to the assertion that the center of gravity of the particles will always be contained in the straight line connecting the extremes g_1 and g_n.

We may now observe that a similar formula applies to the position of the resultant fault in a telegraph line containing points of leakage.

Let $A\,B$ (Fig. 2) be a telegraph line or cable which we may first suppose to be perfectly insulated, except at two points, G and H, where leakages of f_1 and f_2 ohms are respectively situated, their distances from A being d_1 and d_2 ohms by conductor respectively.

Then we know that, provided the current escaping through these faults obeys Ohm's law, *i. e.*, is proportional to their potential, the effect of these two faults is precisely equivalent to that of a single fault of resistance f and distance d from A such that

$$f = \frac{f_1\, f_2}{f_1 + f_2} \quad (3)$$

and $$(d - d_1)\, f_2 = (d_2 - d)\, f_1 \quad (4)$$

That is to say, the resistance of the equivalent or resultant fault will be the joint resistance of the two separate components and its distance intermediate to them will be from each in the ratio of their relative resistances. But since the conductivity of any electrical path is the reciprocal of the resistance of that path, we may call c_1 and c_2 the respective conductivities of the two faults at G and H; so that

$$c_1 = \frac{1}{f_1} \quad (5)$$

and $$c_2 = \frac{1}{f_2} \quad (6)$$

Substituting the values of f_1 and f_2 in terms of c_1 and c_2, in equations (3) and (4), we have

$$c = c_1 + c_2 \quad (7)$$

$$(d - d_1)\, c_1 = (d_2 - d)\, c_2 \quad (8)$$

that is, $$d = \frac{c_1\, d_1 + c_2\, d_2}{c_1 + c_2} \quad (9)$$

where c is the conductivity $\frac{1}{f}$ of the resultant, thus equal to the two component conductivities and situated between them at distances from each inversely proportional to the relative conductivities.

If now a third leakage f_3 be introduced at the point K (Fig. 3), we may consider f_1 and f_2 removed and replaced by f, and then find the resultant of f and f_3. T eir re

spective conductivities being c and c_3, we have, by the reasoning of (7), if C and D be the conductivity and distance of the new resultant:

$$C = c + c_3 \tag{10}$$

and from (9) $$D = \frac{c\,d + c_3\,d_3}{c + c_3} \tag{11}$$

Substituting in these equations the values of c and d from (7) and (9), we have

$$C = c_1 + c_2 + c_3 \tag{12}$$

$$D = c_3\,d_3 + \frac{(c_1+c_2)(c_1\,d_1 + c_2\,d_2)}{c_1+c_2} \tag{13}$$

$$\therefore D = \frac{c_1\,d_1 + c_2\,d_2 + c_3\,d_3}{c_1+c_2+c_3} \tag{14}$$

As each new fault introduced can be similarly compounded with the single preceding resultant, this process and notation may be indefinitely continued, and we shall have finally with n faults

$$D = \frac{c_1\,d_1 + c_2\,d_2 + c_3\,d_3 + \ldots + c_n\,d_n}{c_1 + c_2 + c_3 + \ldots + c_n} \tag{15}$$

where D is the distance of the final resultant from A.

This equation may be abreviated to the form

$$D = \frac{\Sigma\, c\,d}{\Sigma\, c} \tag{16}$$

where $\Sigma\, d\,c$ represents the sum of all the products of the type d_1, c_1, and $\Sigma\, c$ stands for the conductivity of the final resultant, *i. e.*, the sum of all the conductivities. Thus (16) has the same form as (2); c the conductivity of each leak corresponding to g the mass of each particle. So that if all the points of leakage in a telegraphic conductor be represented by an equal number of particles in a straight line at corresponding distances apart, and the conductivity of each leak be proportionately represented by the mass of each particle, the position and conductivity of the resultant fault will be represented by the position and force of the center of gravity of the particles.

It might at first sight be supposed that in the case of two lines connecting two stations —as for instance, a metallic circuit for telephony—when the separate insulations of the two lines were known, and a loop test from each station in turn had determined the position of the resultant fault in the circuits as formed by looping successively at each end, the positions of the resultant faults in each line separately might be calculated. Examination, however, shows that these data are insufficient for the purpose.

Let the line $A\,B\,A$ (Fig. 4) represent two conductors (Nos. 1 and 2) of l_1 and l_2 ohms resistance respectively, connecting stations A and B, looped at B. Suppose the separate resultants of the lines to be f_1 and f_2 ohms situated at H and K, x_1 and x_2 ohms respectively from the end of No. 1 at A. From the insulation tests of these lines separately, f_1 and f_2, hence c_1 and c_2 can be determined with more or less accuracy. Then if a be the distance in ohms of the loop's resultant from the end of No. 1 at A as determined by a Varley loop test, we have by (9)

$$a = \frac{c_1\,x_1 + c_2\,x_2}{c_1 + c_2} \tag{17}$$

If now the wires are looped at A, and B tests the same conductivities, c_1 and c_2 at H and K are now $l_1 - x_1$ and $2\,l_1 + l_2 - x_2$ ohms from the end of No. 1 at B respectively, and if the distance b of the loops resultant fault from the same end be now correctly measured by B, we have similarly

$$b = \frac{c_1\,(l_1 - x_1) + c_2\,(2\,l_1 + l_2 - x_2)}{c_1 + c_2} \tag{18}$$

From these two equations we have

$$x_1 \left\{ c_1\,(a+b) \right\} + x_2 \left\{ c_2\,(a+b) \right\} - a \left\{ l_1\,(c_1 + c_2) + c_2\,(l_1 + l_2) \right\} = 0 \tag{19}$$

an indeterminate equation of the form of an equation to a straight line for knowing c_1 c_2 l_1 l_2 a and b we can find as many conjugate solutions for x_1 and x_2 as we please, so that unless either x_1 or x_2 is known independently, we have no means from these data of calculating either.

A similar case in statics is the following; Let $A\,B$ and $C\,D$ be two rigid rods without weight, of lengths l_1 and l_2 respectively, firmly connected in the same straight line at their ends B and C. Let weights of g_1 and g_2 pounds be attached to the rods at points F and G. Suppose that under these circumstances the system will balance horizontally on a knife-edge at H distant a from A, then the center of gravity of the whole system must reside at H. If now $A\,B$ and $C\,D$ be separated, reversed and connected at the ends $A\,D$ without altering the weights or their points of application, we may suppose that the system will balance on the point K distant b from B. If now the weights g_1 and g_2 be moved along the rods in opposite directions, such as to Q and R or to S and T for example, but so as to still maintain a balance on the knife-edge at K, then on once more reversing the rods and connecting the ends B and C we shall find that the system under the new conditions will still balance on the point H as before.

For taking the moments about the point H (Fig. 6) which we know are equal:

$$g_1\,(a - x_1) = g_2\,(x_2 - a) \tag{20}$$

and similarly taking the moments about K (Fig. 7)

$$g_1\,(b - l_1 + x_1) = g_2\,(2l_1 + l_2 - x_2 - b) \tag{21}$$

From which

$$(a + b) = l_1 + \frac{g_2}{g_1 + g_2}(l_1 + l_2) \tag{22}$$

The last equation being independent of x_1 and x_2 shows that $a + b$ is constant, no matter what values are given to x_1 and x_2, so that, a being fixed, b is fixed also.

But although we cannot localize the separate resultants in this manner, we can for that very reason, knowing the insulations of the two conductors separately, and the position of the resultant in the loop when testing from one end, calculate the position of the resultant when testing from the other end. For in Figs. 4 and 5 suppose l_1 l_2 c_1 and c_2 all known, that a is observed from A, and that it is required to know what b would under these conditions appear from B.

Then from equations (17) and (18) similarly to (22) we obtain

$$b = l_1 - a + \frac{c_2}{c_1 + c_2}(l_1 + l_2) \tag{23}$$

or if f_1 and f_2 be the insulations of the two sections separately, assuming that

$$\frac{f_1}{f_2} = \frac{c_2}{c_1} \tag{24}$$

this equation becomes

$$b = l_1 - a + \frac{f_1}{f_1 + f_2}(l_1 + l_2) \tag{25}$$

For example:—Two wires connecting stations A and B tested as follows:

No. 1. Conductor resistance (corrected) 2370 w insulation 1.5 megohms

No. 2 conductor resistance (corrected) 2530 w insulation 1.3 megohms.

Testing from A the resultant fault was found by a Varley loop test to be situated at 2700 w from the end of No. 1. Then on testing from B the corresponding position from his end of No. 1 should be

$$2370 + \frac{1.5}{2.8}(4900) - 2700 = 2295\ w$$

Thus 2295 w should be the distance of the resultant in the loop from the end of No. 1 when testing from B.

It is evident that this calculation (25) can only give correct results when l_1 l_2 f_1 and f_2 are measured correctly. In particular the ratio $\frac{f_2}{f_1}$ must be accurately determined, for differentiating with respect to this ratio we have

$$\frac{db}{d\frac{f_2}{f_1}} = -\left(\frac{f_1}{f_1+f_2}\right)^2 (l_1 + l_2) \tag{26}$$

or the error introduced into b by an error in the ratio $\frac{f_2}{f_1}$ is multiplied $\left(\frac{f_1}{f_1+f_2}\right)^2 (l_1 + l_2)$ times, and this expression is generally a large quantity.

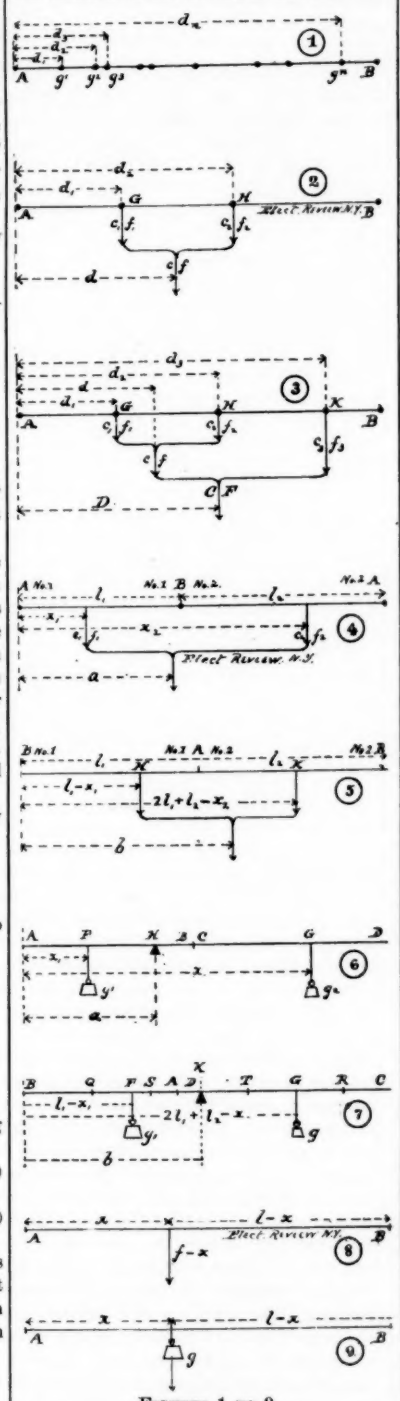
Also the insulation of the lines must be as great relatively to their conductor resistances that the ratio of the observed insulations namely, $\frac{f_1}{f_2}$ shall, with sufficient accuracy, be equal to the ratio of the resultant fault resistances, which is more strictly

$$\frac{f_1 - x_1}{f_2 - (l_1 + l_2 - x_2)} \text{ from } A$$

or

$$\frac{f_1 - (l_1 - x_1)}{f_2 - (x_2 - l_1)} \text{ from } B.$$

If this condition is insufficiently fulfilled, steps must be taken independently to correct f_1 and f_2 for the resistance between station and resultant in the insulation measurement.



FIGURES 1 TO 9.

Finally, the amount of current escaping at any point of leakage in a given time must be proportional to the potential at that point, or, as already observed, must obey Ohm's law strictly, for it is known that films of imperfectly conducting material, such as form on an insulating surface, do not always obey Ohm's law strictly.

In the case of good submarine cables, however, the calculation by equation (25) will be found to give good results if care be taken to measure the ratio of f_1 to f_2 carefully. This is best done by bridge to a particular interval of time. With well insulated land-lines, the result obtained will generally be sufficiently accurate for practical purposes, but the additional restriction of time is here imposed, for the position of the resultant fault in land-lines may vary continually, and is more subject to meteorological influence than of course can be the case with cables, so that all the measurements required should be taken in succession as quickly as possible.

The position of a resultant fault in a single line of any considerable length may be calculated from measurements taken at both ends in several ways. For example, the apparent conductor resistances taken correctly from each end of a line cannot be equal, if the resultant fault be not in the center of the line.

Thus let $A\,B$ (Fig. 8) be a line with a resultant fault x ohms from A with a resistance of $f - x$. Then the insulation resistance observed from A will be $x + f - x$ or f. The conductor resistance r observed from A will be

$$r = x + \frac{(f - x)(l - x)}{f + l - 2x} \tag{27}$$

and the conductor resistance observed from B, say $n\,r$ where n is generally close to unity

$$n\,r = l - x + x\frac{(f - x)}{f} \tag{28}$$

From these

$$x = \frac{l}{2} + f\,\frac{(1 - n)}{2} \tag{29}$$

This equation will only yield accurate results when the ratio n between the two conductor resistances observed at each end is accurately determined for differentiating with respect to n

$$\frac{dx}{dn} = -\frac{f}{2} \tag{30}$$

so that any error in n multiplies $\frac{f}{2}$ times into x, and $\frac{f}{2}$ is of course a large quantity.

For example, a line known to have a conductor resistance of 5320 ohms had an insulation of 152,000 w observed from A. The conductor resistance from A was 5200 w, from B 5313.4 w.

Here $n = 1.021847$; so that $x = 2660 - 0.010924 \times 152{,}000 = 1000\ w$, so that the resultant fault would be 1000 w from A and 4320 w from B. This case has as its analogy in statics the determination of the center of gravity in a rod of heterogeneous substance by keeping it horizontal and measuring its bending moment from each end.

Thus if $A\,B$, Fig. 9, be a rod of length l and weight g whose center of gravity is at C distant x from A, then let the moment of the rod while horizontal about the end A, be measured, and denoted by unity; next let the moment about B be similarly measured and its ratio to the first denoted by n, then we have

$$x\,g = 1 \tag{31}$$

$$(l - x)\,g = n \tag{32}$$

Hence $$x = \frac{l}{2} + \frac{1}{g}\left(\frac{1 - n}{2}\right) \tag{33}$$

This equation corresponds to (29) remembering that $f = \frac{1}{c}$

We have thus seen that not only have the general equations of resultant faults (16), (22) and (29) their statical prototypes, but the former are sometimes practically useful.

LONDON, Oct., 1887. A. E. KENNELLY.

Lightning and Telegraph Wires.

The German government is engaged in a study of the dangers by lightning to the telephone and telegraph buildings. The wires form a kind of lightning conductor. There was a storm on the island of Ruegen in the Baltic Sea, relates the *Post Archive*, during which the wire between Wittow and Arkona was damaged. Lightning struck it some three miles north of Wittow. Six posts were split up. The iron wire, for a length running over four posts, was completely destroyed or broken up in lengths of an inch or two. These pieces show they were heated to white heat, and blisters on the surface show that combustion had commenced. When struck the wires showed a number of lights; it rose and then fell to the ground. The lightning ran along the wire to the postal station at Wittow, broke the ebony tube, and jumped over to another wire, which it followed to the ground. Another portion of the electricity ran along the first wire to the apparatus and went into the ground there, doing the apparatus hardly any injury. To lessen the probability of the recurrence of such damage, underground wires are to be connected with the telegraph.

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We invite correspondence from Electricians, Inventors and the Telegraph and Telephone fraternity and those engaged in Electric Lighting, on matters pertaining to electrical and scientific subjects, and all facts of special interest in connection therewith.

We extend to manufacturers of electrical apparatus an invitation to send to this office any and all facts concerning their business which will be of interest to the public. We make no charge for publishing news.

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Among the weightier measures to be considered at the coming session of Congress, will in all probability be a bill for the establishment of a Government Postal Telegraph system. Wouldn't it be too bad if, after all their success at swallowing the Western Union had to swallow such a dose?

The year 1887, when its electrical history is recorded, will be found replete with most important progress and invention.

There is a six day "go-as-you-please" walking match in progress at Kansas City. If they can go as they please why not have a storage battery in their hip pocket and a couple of electro-magnets actuating a pair of rods slanting down to the ground behind, adjusted to operate at a certain point of the stepping movement? Thus every moment, and at precisely the right time, the walker would "get a lift" onwards, helping him greatly.

A system of distribution of power by compressed air is about to be put in operation in Paris, the object being to furnish motive power to the theaters and other places at each of which an air-motor supplied from the street mains will drive one or more dynamos for lighting purposes. 3000 horse power will be used at the compressing station. This seems to us a step backwards. Reckoning from the steam compressors at the compressing station to the lamps, at distant points, we doubt if a conversion of 15 per cent. can be obtained—or say 2 per cent. of the total energy of the coal consumed. This wouldn't do in America.

In strong contrast with the above is the abandonment, in a colliery near Normanton, England, of compressed air as the medium of transmission of power to the pumps, which are 900 feet down in the mine, and 210 feet away from the bottom of the shaft. With compressed air the efficiency was less than 25 per cent. The compressor was removed, and a dynamo substituted, the pumps being driven by electric motors; the result, it is said, being much more satisfactory. We would certainly look for a much higher efficiency with the new arrangement, than could possibly be obtained under the compressed air system.

A correspondent at Jamestown, N. Y., complains about the abominable state of things there, and asseverating generally that the country is fast going to the "demnition bow-wows," because the local gas company has changed its basis of prices to a definite rate of 25 cents per burner per month, and the arc light providers have scaled down, through mutual throat-cutting, to a rate for arc lights of $4.00 per month per lamp. This is a sad case. The gas is made by simply treating *natural gas*, and of course the cost is insignificant. It is not the gas company's fault, but only their good luck and enterprise. Yet here comes a man actually complaining of the bountifulness of Nature. As to mere cost for light, machine-made electricity can never compete with natural gas, and if our correspondent has the misfortune to live in a town where the esthetic and moral beauties of electric light are not appreciated, he must not blame it on the gas. Why doesn't he slip out and plug the beastly hole in the ground, which is vomiting forth all this unhappiness? If luck be against him, we can only console him with the reminder that "the best laid plans of mice and men gang aft aglee."

INTERIOR INCANDESCENT WIRING.

A correspondent asks: "Is the putting up of wires on cleats against a ceiling as safe a method as wiring on insulators and leaving the wires clear of the ceiling entirely? Water spilling on the floor above would cause a fire in the first case, but not in the latter. Is not safety sacrificed to appearance in this system of wiring?"

Neither plan should be permitted by the local inspector. Underwriters generally insist upon the use of wood molding strips, where the two leads occupy separate grooves at least one-half inch apart, and the wires themselves must have a waterproof covering. Besides being the safest plan, this also gives the best appearance, as the molding can be selected or stained to correspond with the neighboring woodwork.

ROWLAND'S DYNAMO OF 1869.

To the Editor of Electrical Review:

My attention having been called to an article lately published in the ELECTRICAL REVIEW, on an early dynamo of Prof. Farmer, it has struck me that it would be well to describe a dynamo which I think has never been sufficiently noticed.

It was built in 1869 by H. A. Rowland.

The armature of this dynamo has been lying for some years in a case in the physical laboratory at the Johns Hopkins University; the magnets are missing and the commutator has recently disappeared. Still enough is left to show the principle on which it was built.

The first drum armature on which the windings completely covered the core was in the proposed dynamo of Worms de Romilly, patented in France in 1866. This machine was wound, however, so as to give only two opposite impulses per revolution, their direction being rectified as in the early shuttle dynamo of Siemens

Rowland's dynamo was built without knowledge of this, the only resemblance being that in both, the coils completely cover the core. The field magnets were of the upright single horseshoe type, used at present in the Kapp and other dynamos—a form which offers some important advantages.

The armature is of the drum type, the surface being covered with wire, wound on a shell within which is a solid iron core. The wire is wound in six separate coils, the ends of three of these coils are taken to one end of the armature, each coil terminating in the opposite segments of a six-part commutator. A single pair of brushes bore against this commutator and put in circuit that coil which was in the most favorable position; thus giving a continuous current and cutting out the coils that were adding comparatively little to the E.M.F. The remaining three coils were taken to the other end of the armature, where the current used in magnetizing the field was taken off in the manner described above.

The solid iron core of the armature is mounted on an axle that fits in bearings fastenened to the outer shell on which the wire is wound. The core moves freely in these bearings, and it will be seen that the advantages of this arrangement in eliminating losses due to currents induced in the core are very great. Such currents would be in a direction to resist the motion causing them. So the velocity of rotation of the core would only increase until this resistance was equal to the slight friction of its bearings. Instead then of a solid mass of iron revolving rapidly in a strong magnetic field—as in the other machines of that and even of later date—we would have the core rotating slowly and causing little waste.

Such is a brief description of a dynamo built in 1869 by a schoolboy. It is not only a great advance over the dynamos of its date—I think we can say it is the first really continuous current dynamo made—but it would compare favorably in efficiency with the machines of six or eight years ago, and I have little doubt that if tested to-day it would prove more efficient than some of the dynamos used now for electric lighting.

LOUIS DUNCAN.

Baltimore, Oct. 25.

Sioux Falls is a good point for a lecturer on the safety of electricity as compared with gas. The ruins of the recent gas works would make an excellent object lesson. These blew up with a "dull thud," on the 26th of October, quite unexpectedly, and scattered the remnants along radii, some fifty feet. Fortunately only one individual was injured. The occasion of the explosion is found in an unsuccessful attempt to make water gas, and it resulted in a loss of $25,000.

The increase in telegraphic rates, as far as can be ascertained, is as follows: Alabama, 60 to 75; Arkansas, 60 to 80; Connecticut, 20 to 40; Delaware, 10 to 25; Georgia, 50 to 75; Illinois, 20 to 60; Indiana, 10 to 25; Missouri, 20 to 60; New Hampshire, 20 to 40; New York, 20 to 40; Ohio, 20 to 40; Pennsylvania, 10 to 25; Rhode Island, 20 to 40; Texas, 60 to 75.

OUR CHICAGO LETTER.

(From a special correspondent of the ELECTRICAL REVIEW).

Prof. Barrett, at the request of the city council, has been doing some considerable figuring on the electric lighting of Chicago.

The council seem to have come to the conclusion that in some new dictionary, by and by, there will be a new definition to the noun, *trust*, as applicable to its use in combination with gas, sugar, oil, and all the other necessaries of life. In the present instance it is its combination, its hyphenated relation to gas, which has been the cause of the Chicago lighting excitement.

Well, the professor has been for some time at work at this problem, and somebody interviewed him the other day, when, out of the "hidden recesses of a secret drawer"—much as the fairies, and ogres, and gnomes of old used to find all sorts of things in impossible places—out of the drawer came a map, with every square on the south side between 12th and the river, and the south branch and the lake. The location of every street and outside gas lamp in the area described, about one square mile. The number of lamps as above shows—

Public lamps	1,131
Private outside do	224
A total of	1,355

The street intersections count up 150, and usually one arc light at each of these is considered sufficient. "But," said the professor, "let us figure on two. That would make 300 lamps. Let's use that figure, so that in emergencies—alleys, long blocks, etc.—we will have plenty of light. The lamps will be placed 300 feet apart at street intersections, so placed that a block will get the rays of light from every direction—a plan that will give us more light than any city in the world to day."

The professor's plan places a lamp at the opposite diagonal corners of each square; say the northeast and southwest corners. This gives each street crossing two diagonally opposite lamps.

A comparison of the amount of light by the gas and the electric lights shows immensely in favor of the latter:

1,131 street burners, at 16 c. p., will give us, in candle power	18,096
300 arc lamps, @ 2,000 c. p.	600,000
Excess in favor of electricity	581,904

or over thirty times the amount of light now bought by the city at a heavy profit to the gas companies.

It may be said that the assumed 2,000 candle power is in excess of the actual amount of light dispensed. It is; but on the other hand, the burners on the street lamps are fully as far away from the assumed photometric value of these. What with water in the pipes, sand in the burners, air in the gas and deviltry in the trust, 2,000 candle power for a full arc light is not an extravagant basis from which to figure.

"Now as to the cost," said the professor, "I haven't reached that part of my researches yet, but let's take a basis. We're constructing now on the river a plant of 100 lights. That will be the most expensive plant we can construct, on account of the high rate of insulation required by being placed on the river and the expense of getting at the viaducts. That plant will cost nearly $300 per lamp. This proposed plant will, of course, cost much less. You must understand that if we get a greater number of lamps we can get them cheaper in their ratio as to the cost per lamp. The probable cost of a street lamp, including everything will, therefore be about $275. Let's figure on that basis, though it is but an approximate figure. The construction includes all labor necessary to place the lamp in operation.

"Let's look at the gas. On the north and south sides we pay $17.12 per lamp each year. The 1,131 lamps would, therefore, cost $19,362. The electric lamps cost $275 each. There are 300 of them—that would make a total of $82,500. The maintenance of the lamps will be $50 each per year. This will cover all maintenance expenses. Add on 5 per cent. interest on the cost of your plant, $4,125, and $19,125 will cover running expenses and interest on money invested for a year."

One square mile of electricity would cost

the first year $101.625, while for the second and after that $19,125 would cover all expenses. The gas lamps cost $19,362 per year, thus giving electricity a financial balance alone of $237 a year.

The district for which the city council wants figures is a little over three square miles in area, and the cost of an outfit, including the expenses for running the same, would be something like $325,000.

Another scheme which the professor has been figuring at for some time, accidentally leaked out the other day, and is now public property. It is the misfortune of an inventor that he is compelled to take into his confidence others, whose appliances or apparatus or machinery is necessary to the development of an idea. Some one once said, when asked for some secret information, "I know it now—that's I. If I tell you that is II. You tell one party that is III. No, I think I will keep it where I will only know.

But to the new scheme. It includes an accumulator battery, an arc lamp, an adjustable reflector, and other necessary appliances, mounted on an expressly arranged wagon, in charge of the department, to be used as a search light in case of fires.

These are some peculiarities in the arrangement of the various parts which are matters of experiment, but it will go—as everything he suggests does—and we shall soon have one of this form of light at every fire, to be used in case of necessity. Eventually there will be several scattered throughout the city.

There have been several fires in Chicago where such an application of electric lighting would have been of immense value in saving lives—notably at the Farewell Building fire, a year or so ago, and at the Langham Hotel. On the occasion of a fire on Madison street, over a year ago, the fire was mostly in the rear of the building, and was most readily reached from the alley.

About sixty or eighty feet away, an electric light blazed fiercely, and shed its rays over the scene, as if in sympathy with the toiling fire worshipers, and aided greatly in handling the fire.

The matter of electric lights for such occasions was even canvassed long before that, and the hope that some one of the thousand and one inventors who advertised that the primary battery for electric lighting had at last been found, would prove to have told the truth, delayed experiments until quite recently, when the professor fell back on the only—up to date—feasible system of search light for land fires.

A week ago the Postal and United lines were wildly waving their arms in the air, and shouting to the citizens of Chicago, "Now that you have lost your Baltimore and Ohio, come to us, 'ye weary and heavy laden, and we will give you rest.'"

"A proposition to act in harmony in the matter of rates has undoubtedly been under discussion by representatives of the two companies for some time, but how far it has progressed I don't know," said an official of the Postal company. "I think, however, that some agreement will be made to sustain both land and cable rates, and possibly to advance them a little. There is absolutely no money for the companies in the present low rates."

The "Pirate," as the Baltimore and Ohio has been called, is out of the way. The sympathy which opposition lines felt for a suffering public could not withstand the first white frost, and we shall probably be made to know in the near future, that "Harmony in the matter of rates" means just one-half of a Bland dollar from Chicago to New York—there or thereabouts, every time you wire ten words between the points named, between sun and sun.

There is a cloud in the matter of taxing the telephone company here. It breaks and gathers and rolls and breaks again. The possibilities in the case are about as uncertain as the whereabouts of the litttle joker in a game of thimble-rig.

One day the prospect, bright and shining, looms up like a daisy, and the next day down it goes to grass, crushed ruthlessly under the heel of the law department's ruling. Anon it bobs up, and dances round like a whirling dervishee, and again is knocked flatter 'n a flounder, because of the want of legality in the stiffening.

The last claim is that the present company could not, by the terms of the contract, become a legal purchaser of the original franchise, which was granted the Bell Company in 1878, and that furthermore, the Bell Company have lost their rights by non-usance, inasmuch as that company only operated under it for two years and then sold out.

It is said that the Chicago Company has indirectly proposed to pay a revenue to the city of five dollars per instrument, if certain additional franchises were granted the company in outlying districts.

This is the latest; but another week may materially change the status of the affair. One thing is certain: the aldermen are after the Chicago Telephone Company with an earnestness that is far from agreeable to the said party of the second part.

The Consumers' Electric Light Company of Chicago, with a capital stock of $15,000, purposes furnishing light to stockholders. Incorporators are J. C. Schumacher, August Melges, M. Wilmersdorf.

Mr. Chas. H. Cone, of the Electrical Supply Company, is gathering his traps and calamities to remove to Kansas City. Charley wants to be nearer his constituents, and is going to make his headquarters there, from whence he will radiate into territory centering at that modern Boomville. Charley has hosts of friends, and he carries the best wishes of all, wherever his lot may be cast.

CHICAGO, Oct. 31, 1887.

His First Telephone Experience.

"Say, mister," said a rather roughly dressed man, as he walked into one of the railroad offices in the Bottoms, at Kansas City, says the *Journal* of that city, a few days ago, "have you folks got a telephone here?"

"Yes, sir," said the clerk addressed; "would you like to use it?"

"Yes," said the visitor. "Ye see my friend Bill is up town and I want to talk to him without having to go away up there."

"All right," said the clerk, "just step into that little room there and you'll find the telephone."

The man accordingly walked into the little apartment, and putting his hands into his pockets, surveyed the instrument for a moment and then said: "Oh, Bill." He waited a moment, and then in a perplexed manner, said in a little louder tone of voice, "O-o-o, B-i-l-l." By this time the clerks were convulsed with merriment, which was not lessened when the countryman approached the clerk he had previously spoken to and said: "I say, mister, I can't make the goll-darned thing talk."

"I guess you didn't talk loud enough," said the clerk. "Better try it again."

"I dunno," said the man, doubtfully, but he walked up in front of the telephone, and in a voice that almost raised the roof and caused neighboring pedestrians to wonder who was being murdered, shouted: "O-o-o-o, B-i-l-l-l!"

The occupants of the office roared, and the man evidently concluded that his efforts were useless, for he emerged from the telephone room with a very disgusted appearance. "Say," said one of the clerks, "you had better put that tube hanging up there to your ear and talk through the transmitter. But if you see any light around the instrument, look out, for it is liable to go off."

"Well, I'll just go up town and talk to Bill," said the granger. "I hain't got no use for these new-fangled machines, anyhow," and he departed in a disgusted frame of mind.

—— Chas. A. Schieren & Co. report sales of electric leather belting during the past week to the following parties: Natick Electric Light Co., Natick, Mass., 42 ft. 10 in. double; Skowhegan Electric Light Co., Skowhegan, Me., 29 1-3 ft. 8 inches double; Mahoming Electric Light Co., Youngstown, O., 47 ft. 8 in. double—47 ft. 10 in. double; Portsmouth Electric Light Co., Portsmouth, N. H., 65 2-12 ft. 4 in. double; Chas C. Clausen, New York, 62 ft. 1 in. double; Monadnock Mills, Claremont, N. H., 300 ft. 3 in. double.

OUR KANSAS CITY LETTER.

(From a Special Correspondent of the ELECTRICAL REVIEW.)

Mr. Warren Watson, secretary of the electric railway company, has been endeavoring to establish an electric line in Clinton, Mo., but up to date his negotiations have been unsuccessful, on account of the backwardness of Clinton's capitalists.

The absorption of the Baltimore and Ohio Telegraph Company by the Western Union has greatly increased the business of the Postal Telegraph Company, and it is already taking steps towards extending and augmenting its present service, so as to be able to meet the demands made by the new patronage.

A new cable containing seven wires is being laid in the Missouri river at St. Louis, at present, the wires all running to Eastern points. Two new wires between St. Louis and Chicago, also, are completed. These, however, were started some time ago, so that the increase in business has only the effect of hastening their completion. The work of establishing branch offices in various parts of St. Louis and other cities, and new offices in places heretofore not so supplied, will also be pushed with greater vigor than there was any call for previous to the closing of the Baltimore and Ohio deal.

The Electric Construction Company of Lawrence, Kas., has been incorporated, with a capital stock of $25,000. The directors are C. W. Cook, E. Rousel, J. E. Jeffries, F. A. Mead, E. P. Tremper.

John R. Strugnall, of Chicago, an expert electrician, is struggling with the distemper of the Atchison, Kas., electric light system.

Marion, Kas., was illuminated with electricity last week, for the first time.

Electric motors are in use in Abilene, Hutchinson and Topeka, supplying power to presses, elevators and machinery of various kinds.

The first grand ball given by the telephone and electric light linemen of Topeka, Kas., occurred last week, and was very successful in point of numbers and the enjoyment of those in attendance. The hall was brilliantly lighted with myriads of incandescent lights, and a chime of electric bells and numerous telephone instruments, properly connected, made the boys feel very much at home. Before announcing each dance one of the floor managers called attention by pressing a button which rang a chime of bells.

The Midland Electric Company, of Omaha, Neb., is a prosperous institution. It has recently moved into new and better quarters, which have been fitted up expressly for an electrical establishment. These quarters are also supplied with facilities for exhibiting the actual workings of the different apparatus supplied. The company is doing a good business over the Western as far as Portland, Oregon.

Every light that the Ottawa, Kas., electric light company is able to furnish is in use, and there are applications piling up for additional lights. The company will probably enlarge its plant.

The telephone war at Memphis, Tenn., is ended and the merchants have been victorious. At a meeting of the committee appointed by the subscribers it was decided to resume the old rates, $48 and $60. James E. Caldwell, one of the Directors of the Cumberland Telephone and Telegraph Company, drew up the agreement, which has a stipulation providing that should any great expense be inflicted on the company it could increase the rates of rental by giving a three months' notice. The subscribers have met and approved of the above agreement, and ordered their telephones to be connected again.

Applications for space in the exposition are still coming in. A letter was received from E. H. Emery of New York city who wishes space in which to display his electric current sewing machines. He has his own motor and wishes to know if there is a dynamo in the building. This question sounds a little odd to those who are aware of the fact that there is now exhibited in the building one of the finest electric displays in the world.

Another trial trip of the Julien-Brush electric car was made at St. Louis last week. When the last trial was made a few days before, only a portion of the line was traversed. This time Secretary Baumhoff and Bagnell, the electrician, ran the car over the other whole of the road. It was intended to see how the motor worked on a wet track going up the grade. With a load of passengers—riding free—the ascent was made with the greatest ease and with no perceptible effort. The newly-painted car moving along the avenue without horses, or any visible motive power, was an object of great curiosity and wonder to hundreds of pedestrians who saw the car pass. Several more trial trips will be made at night and the car will then be sent back to the shops, where the Brush motor will be replaced by a Sprague and more experiments made.

KANSAS CITY, October 28.

OUR ST. JOSEPH LETTER.

(From a special correspondent of the ELECTRICAL REVIEW.)

The first meeting of the St. Joseph Electric Club was held last Monday night at the office of the electric light company, corner of Third and Felix streets. Mr. W. C. Stewart was elected temporary chairman and W. M. Yenawine secretary. A committee consisting of W. C. Stewart, I. T. Dyer and J. H. Parker was appointed to obtain prices on carpets, furniture, apparatus, etc., and report at the next meeting.

In pursuance to the call the club met Wednesday night at the office of the superintendent of the electric light company. W. C. Stewart was called to the chair, with W. G. Hall secretary *pro tem.*, after which the following permanent officers were elected: W. C. Stewart, president; Wm. G. Hall, vice-president; W. H. Taylor, secretary; J. M. Austin, treasurer.

The president appointed a committee on constitution and by-laws, consisting of Dr. W. G. Hall, Dr. J. M. Austin, and Thomas H. Elfred.

The electric officers were appointed a committee to procure suitable rooms and furniture for the same.

On motion the charter members were assessed a special assessment as a membership fee.

W. C. Stewart, A. H. Stewart and C. R. Berry were appointed a committee to collect the assessment fee.

The next meeting was called for Saturday evening, at 8 o'clock, at the office of the electric light company.

The president was requested to give, at the next meeting, a lecture on the aims and purposes of the club.

The club proposes to raise the standard of electrical work, and will carry on a theoretical and practical school of instruction. In their rooms will be a complete collection of the principal varieties of dynamos and electrical generators, all in working order and ready for practical or experimental service. Monthly lectures by the electricians in the city will be given, and to these lectures linemen and electrical workmen in all departments will be invited.

Mr. Chas. Rolfe, representing the Gamewell Fire Alarm Company, was in the city during the week. He hopes to be able in the near future to establish the Gamewell system in St. Joseph.

Will W. Low, representing the Detroit Electrical Works, was in the city yesterday, and sold quite an amount of electrical supplies.

The electric light company received yesterday a large installment of incandescent lamps to use on its circuits in the city.

The Union street railway company will run the new electric motors to New Ulm park to-day, and expect to be able to carry a large number of passengers.

The telephone company has raised the residence rate to $50 a year, the same as business houses. G.

ST. JOSEPH, Mo., Oct. 29.

Telephonic News

*** There are 249 subscribers to the telephone exchange at Macon, Ga.

*** The telephone investigating committee is working over the records of the Buffalo company with great zeal.

*** President T. N. Vail is taking active interest again in the affairs of the Metropolitan Telephone Company, New York City.

*** The Missouri and Kansas Telephone Company is looking over the ground with a view of putting up a line between Wichita and Kingman, Kas., making stations at Garden Plain, Godard, Cheney and Murdock.

*** The Flad tower system of conducting electric wires overhead is being perfected in St. Louis. The plan provides for towers, carrying the wires in cables, above the height of ordinary buildings, and out of the way of the fire department. The towers are to be from 400 to 1400 feet apart, and the standards are to be of large pipe, and will also be used as stand pipes, under the control of the fire department.

*** The statement that Chas. J. Glidden, treasurer of the Erie Telephone Company, had resigned, is officially denied at the Erie office, and probably grew out of the following: Previous to Mr. Glidden becoming a member of the firm of Cordley & Co., he offered to the board of directors his resignation as treasurer, but the directors were urgent and unanimous that he should remain, which he consented to do for the present.

*** Electrician Seeley, of the Metropolitan Telephone Company, possesses a very unique and historic collection of insulators. One manufactured by M. L. Wood, in 1865, is made of iron with porcelain inside. Another made by Prof. Leffarts in 1845 is of wood, quite large, and is the only one of the kind now in existence. Early French insulators are shown, costing 50 cents each; Austrian, 38 cents each; Prussian, 12 cents each; Belgian 12 cents.

*** The American Telephone Improvement Company was organized in Portland, for the purpose of purchasing and holding patents of Stephen C. Drew. President, Chas. H. Drew; treasurer, Horatio N. Holbrook; directors, Chas. H. Drew, Horatio N. Holbrook, Stephen C. Drew. Capital stock, $1,000,000; paid in, $1,000,000, by assignment to the company of a certain invention of Stephen C. Drew, which the directors purchased for $999,800 in stock and $200 in cash.

*** At a meeting of the directors of the New England Telephone Company, held October 26th, a dividend of 75 cents per share was declared, payable Tuesday, November 15th, to stockholders of record at close of business October 31. The following is a statement of the business of the company for the quarter ending September 30, 1887:

Gross receipts for three months, ending September 30	$ 255,855 77
Expenses	174,736 96
Net earnings	81,118 81
Construction, 3 months ending Sept. 30	1,148.92

*** Mr. J. W. Rogers contradicts several of the statements made by Mr. Chandler concerning the missing telephone papers. Mr. Chandler said that "as all the exhibits had been printed they could be supplied. Mr. Rogers had the record printed, and it is absolutely correct." Concerning this statement Mr. Rogers says: "The record consists of a condensed synopsis of the bill, and also of some of the exhibits (condensed and abbreviated) which pertain to the demurrer only; while other parts of the bill and exhibits pertaining to the final cause are not printed at all in the record which Mr. Chandler says is absolutely correct." Mr. Rogers also says that the side he represents is put at a disadvantage at the hearing by the absence of the papers, because, the printed record being merely a condensation of the pleadings, it is often absolutely necessary to refer to the unprinted portions of the partially printed exhibits, and asks, if the whole record can be made up from his printed documents in the clerk's office, why Mr. Chandler does not make it up at once and deliver it to Mr. Meigs.

Up Go Telegraph Rates.

A CONTRACT SIGNED WHICH COVERS THE LAND LINES, AND MACKAY'S CABLE LIKELY SOON TO COME TO TERMS WITH THE CABLE POOL.

That Mr. Jay Gould intends to have his favorite properties in good shape when he sails for Europe was indicated by the progress that he made yesterday toward gathering in the skirmishers in the telegraph war, remarks the *N. Y. Sun*. He captured the main body of the enemy when the Western Union Telegraph Company bought the Baltimore and Ohio system. This left only the United Lines, consisting of the Postal Company and what is left of the Bankers' and Merchants' lines, as competitors.

Their competition has been important, though the combined systems are not very extensive, for the reason that they reach a large number of the larger cities For instance, the Bankers' and Merchants' has good lines from this city to Washington, and from this city to Boston, and of course in both directions to the intermediate points. The main line of the Postal is between this city and Chicago, and west from Chicago it has control of the old Board of Trade lines to St. Paul and to St. Louis. In addition it recently made a contract with the Canadian Pacific Railroad for the use of its telegraph system to the Pacific coast, and thus established a line to San Francisco. The United Lines have made some very low and unprofitable rates which the Western Union has met through its leased line, the Mutual Union.

Just what has been accomplished under the surface it is impossible to say, though representatives of the several interests agree that there has been no sale of the property of the competitor companies to the Western Union or to Mr. Gould and his associates. The United Lines, however, have ceased to be competitors in the sense of rate cutters. A contract was entered into yesterday, whereby the United Lines and the Mutual Union agreed to advance rates to figures approaching those named in the Western Union schedule. The new tariff sheets had been in preparation for several days, and as soon as the contract to advance and maintain rates was signed the orders were issued to advance rates to the new schedule on Nov. 1.

The final conference on the matter was held yesterday between Mr. Gould and Manager Brown, of the Mutual Union, and Messrs. Chandler and Rosner, representing the United Lines, and more especially the Postal Company and Mr. Edward Lauterbach, representing the Bankers' and Merchants'.

Mr. Gould was one of the first to confirm the current reports of what had been done. He said that he considered it quite as important a step as any that had been taken in telegraph matters lately. It ended unprofitable strife. Another telegraph man said that uniform or nearly uniform rates meant that Western Union would get practically all the business, as there was no longer any inducement for a patron of the telegraph to look up the office of an opposition company.

None of the parties to the deal was inclined to give details of the contract; in fact, the officers of the United Lines were reluctant to speak of the matter at all. General Manager Ward, of the Commercial Cable Company, which, like the Postal Telegraph, is controlled by John W. Mackay, of San Francisco, said that the contract did not extend to cable rates, and that so far as he knew there was no change in the cable situation, except as people might see it foreshadowed by the agreement that had been made on land rates. The natural inference is that, having brought his land system into harmony with the Western Union, Mr. Mackay will not be slow to avail himself of the opportunity to put his cable upon a more profitable basis by advancing cable tolls with the pool cables that are a part of the Western Union system.

Magnetism in Watches.*

BY C. C. HASKINS.

The restless march of progress carries with it, either as part of itself or as camp followers, the entire world of art, of science, of invention. Advanced civilization heralds a newborn necessity; progress clamors for an invention to satisfy the hunger or clothe the form of the whimpering babe. Twenty-five years ago men would have thought it indicative of imbecility to have ridden in a street car. The lakes were good enough for any traveler and in the days of those side-wheeled floating passenger palaces that transported and fed and slept emigrants enough on a single trip to people a Dakota village, the world was satisfied to move at a much slower pace than now. Strap rails and longitudinal sleepers bore trains that could hardly keep ahead of the farmers' yelping dogs that followed them, and a single track was sufficient for all the needs of the traffic along roads where to-day there are double and quadruple tracks; and the vibrations arising from the passage of one train hardly subside before the echoes are again awakened and another monster engine hastens on in the wake of its predecessor.

In those old days there was not the necessity, as to-day, of an accurate time-piece in the pocket of the conductor or the man at the throttle. One passenger and one freight each way was in many, very many, instances all that was required of the road, and there was almost no end of roads where two engineers and two strikers, as they were often called, comprised the total entry on the pay sheet, under the heading of "Engine Service."

Along about the middle of the road somewhere, there was a meeting point for the two trains; but there was no telegraph, and there was no necessity for a dispatcher. The trains met at that point, or they flagged, and that was all there was of it. The passengers all knew the train men, and seemed, as a rule, to enjoy any little delay there might be, especially if the side track was near a berry patch.

As a contrast to the present way of handling that sort of thing, let me give you the result of an invention by the chief engineer of a road which I think first came here from the East, and which is to-day one of the busiest thoroughfares in the chain of roads from ocean to ocean. Business had so increased that it became necessary some means of better accommodating the traffic should be invented. The invention came, and a copy of the time card which was the result of that invention would be a curiosity to-day. The time of train number one was given as it now is. As long as that train kept on time it was run by that column; but when it fell a certain number of minutes behind, it was run upon a second time column, called "first delayed" time; and a "second delayed" time filled the third column of the table, as it was called. When his third right was lost, the balance of the trip was made in the wake of a brave boy, who carried the red flag of distress, and had no rights that even a ditching train was bound to respect.

I once heard a construction train conductor claim to the superintendent that his bullseye watch was correct because he set it by the minister's time. It was Monday morning, and having tired of the long sermon, he had played with his watch in church the day before, and corrected it by the clock over the pulpit.

Times, men, methods, all have changed. A minute to-day is equal in value to what several were in the olden days. That kind of time, that sort of watch, that order of conductor will hardly fill the needs of to-day; and more than that, it is fast becoming acknowledged that no ordinary pocket timepiece can be thoroughly depended upon under all circumstances. When every town from New York to San Francisco had its own individual time, the variation of a watch was scarcely noticed as it is to-day, when to prove your watch is right it must be either with standard, or at least an hour away from it. Engineers and conductors know the failings of watches, but the causes which lead to the wild movements of these at times, belong to a study which is out of the direct line of railroad education. It is magnetism—that peculiar property which enables iron, steel, and some other metals in a lesser degree, to attract pieces of iron or steel, when brought near them. The earth is one huge magnet with a north and a south pole. We find by investigating that nearly all the iron and steel about us is more or less affected—has more or less permanent magnetism resident in it. Pure, soft iron retains but a very minute quantity of magnetism, but steel, especially when high tempered, is capable of retaining a much greater quantity of magnetic power.

Now, the distance which this power is capable of making itself felt is astonishing, and is, so far as we can judge, illimitable. We know that the earth's magnetism is felt from the equator in either direction to the poles, and unfortunately that is as far as we can conveniently measure. Its striking distance is proportioned to its strength.

The ordinary magnetic compass needle, as you all know, in its normal condition lies in a general north and south position. One end of this needle is of north polarity, and the other of south polarity. The end of the needle usually called the north end is in reality the south, or north-seeking end of the needle. When two magnets are brought near each other, and permitted free motion, the poles which are of similar names repel each other, while those of dissimilar names, or opposite polarities, attract. North and north, or south and south, repel; but north and south attract.

Magnetism has no weight. The earth's magnetism is simply directive. The most carefully conducted experiments fail to show that a vertical thread, sustaining a horizontal magnet, is drawn in the least from its perpendicular. There is, however, a peculiarity pertaining to a magnetic needle which is worth mention, and corroborates the theory that the earth's magnetism is the power which holds the needle in its north and south position. If, before a needle is magnetized, it is accurately balanced, so that it rests perfectly level, no sooner is it made a magnet than the end pointing to the north assumes a lower level than the opposite end, as if it were heavier. This is called the dip, or inclination, and is due to the fact that, owing to the rotundity of the earth, a direct line from Chicago to the north pole would necessarily point a little downward.

You see from this compass action, that it is not necessary there should be contact to produce magnetic effect. The statement may appear startling, but I am greatly inclined to the belief that the majority of all the watches in the room are to a greater or less degree magnetized. How can I assume and seem so positive of this, you may ask. One thing is certain—we can test the statement. I have told you that the opposite poles of two magnets attract, while similar poles repel. Every ordinary magnet has a north and a south pole. No matter if it is no larger than a chip of iron cut off by a dead smooth file—it has polarity. We only need a freely moving magnet to determine the fact. If your watch, laid on the table alongside a delicate compass, moves the needle either to the right or left, and as the watch is turned horizontally if it reverses its action on the needle, there is magnetism in the watch.

You cannot depend upon the action of your watch when that magnetism is there. Have you none of you ever known a case where a good watch did excellent service while the owner was well, and refused after he had been sick awhile to keep as good time as before? I knew such an one, and the baby hadn't tried to clean the watch either. During an illness of some weeks the watch was hung always in one spot, and in one position, and it became so thoroughly magnetized that when it was again worn it lost

* Paper presented to the 24th annual convention of the Brotherhood of Locomotive Engineers, held in Chicago from October 19th to October 29th, 1887.

time so that it was finally sold; but its owner never knew what ailed it. Remaining in one position twenty-four hours a day for several weeks, magnetism had crept in—the spring, or the balance, the screws, or the case spring, or something, perhaps all these parts, for they are all steel—had become permanent magnets, and its conduct was such that its owner never dared depend upon it afterwards.

This effect of magnets or of magnetic attraction and repulsion is by far more universal than most of us are aware of. If we take a small cheap compass, and hold it down to the rail you are daily running over, or a street car rail for that matter, the needle will swing round so as to point to the rail. Now move it along the rail. If this lies in a north and south direction you will find that one end of the needle will be attracted by the north end of the rail while the opposite will attract the other end of the needle.

If your rail lies in an east and west position, you will find your north and south polarity lies crosswise of the rail, and you will make your needle reverse by changing sides, instead of ends.

Try an iron bridge. You will find that there is polarity there. Your locomotive, that you thought you were pretty well acquainted with, has a little trick that you had never thought of. Some parts of it you will find magnetic, and you may possibly find by careful examination that when it is blowing off steam there is considerabie electricity evolved at the safety valve. Try the stove-pipe in the round-house or the shop; pass your little compass up and down the stove-pipe, and see how it acts. At every joint you will find a change of polarity, probably. You will find it in the line shafting and in the anvil of the blacksmith's shop, in the vise and in the files. You will find it—almost everywhere.

How did it get there when there has been no contact with anything magnetic? How is the needle held in its normal position? The earth's magnetism does much of it, but not all. And here comes in play a comparatively recent discovery, which has probably done more than anything else to bring this matter to the surface, to aid in explaining the phenomena, and thus suggesting some remedy for this chronic insanity in timepieces.

Electricity, and magnetism, and heat, and light, are convertible and re-convertible. Where one is, the other may be made manifest. We shovel coal into the furnace, and heat is developed. The energy set free is shown in the pressure of the steam. Admitted to the cylinder, this moves the piston, drives the pulley, runs the dynamo, generates current by changing magnetism into electricity, and this last shows itself at the lamp as heat and light.

This same current, if we choose, we may carry to a motor, re-convert it into magnetism, and run the motor to turn a lathe or a planer, a pump or a saw.

Now, if we are at any time or in any place free from the deleterious influences of these forces—deleterious to our watches—it must be in some place and at some hour where and when we are seldom seen.

When I tell you that, as a rule, every steel screw at the watchmaker's shop lying in a drawer in the original package is a magnet—when every hair spring with the original wrapper still protecting it is a magnet—that if you take a package of cambric needles home from the dry goods house, and drop one lightly on the water so it will float, it will point north and south, unless it has become polarized cross-wise—and the little hair spring will do the same thing—how can you expect that your watch will escape the general result? When I tell you that every electric light current is surrounded by magnetic whirls, that it is, in fact, a magnet, that a wire carrying current will show its magnetic power by attracting particles of iron, how will you protect those portions of your watch which are thus constantly threatened?

But you may say, My watch doesn't play me false, I keep too good a watch on it. True. It is necessary. If there is any one thing a man knows, it is what time it is.

There is an old saying that every heart has its own troubles. So has every watch owner. I presume there are so such engineers now-a-days, but I have known engine and train men in former times who daily compared watches with the clock in the old man's office, and swore they were right with it; but they often lingered in the hall just about long enough to set a minute hand, before going down stairs.

It is sometimes quite amusing to start the question of time in a crowd. Usually there are as many different reports as there are watches, and every owner is dead sure his is the right time.

That sort of time answers very well for a crowd on a street corner, or the people who wait to see the train go by a village station; but for the man in the blouse whose hand is on the throttle lever, something more relia ble is necessary. His responsibility is one of too proud a nature, too serious a character for trifling, or uncertainty.

To return. Having shown pretty clearly, as it seems to me, that watches do become magnetic, a word or two of how this affects the rating of their movement. You all know the advantage which a direct application of power has over an indirect one. In the daily walk of life your magnetic watch changes position relative to the magnetic attraction of the earth—what we call the "lines of force," many times in a minute. The balance-wheel, when your engine is running in a given direction, is playing in the plane of these rays of magnetism. You strike a curve, right or left, and your balance-wheel cu's these lines of force, these magnetic rays, at an angle. Another curve, and another—railroads are never perfectly straight, except on maps—and at each successive change a different angle, and consequently a different strength is exerted by these lines of force. Sometimes they may increase the sweep of the balance in one direction, but taken as a whole, they retard it. Their action is the equivalent of a drag on the wheel—a friction, a brake, if you please, to slow up its action. Now, a watch so affected on the engine is surrounded by metal for which a magnet has a decided attraction, and a large part of the iron of a locomotive, save where heat destroys it, is magnetic. Can it be otherwise than that an engineer's or a fireman's watch should be more or less affected?

Another fact relative to the readiness with which iron or steel may become affected, you may be interested in, and you may very easily prove or disprove this by experiment. If you will hold a bar of iron in a north and south line, and strike the end smartly with a hammer, you will find you have made a magnet of it. Now, if you reverse it and strike the other end you will have changed its polarity. That which was its north end is now its south extremity. Striking the bar jars the molecules of the metal, and permits of their more readily grouping or arranging themselves in magnetic form, or of accepting and retaining the magnetic condition, and these jars and blows are always present in your work. Friction, too, and other causes, act to produce the same results.

The question naturally arises, What can be done to remedy this evil? Prevention is better than cure, the doctors tell us, and if there could be some way discovered by which this watch blight could be prevented from getting in, there would be no need of devising ways and means of getting it out.

This question, "How can I bar magnetism out of the balance and hair spring of the watch?" presented itself very forcibly to Mr. C. A. Paillard, an adjuster of watches, residing at Geneva, Switzerland, who originally conceived the idea of leaving out that part of the watch which was so constantly causing trouble, and substituting something which would do its proper work without interfering with its regular duties.

At first thought it does not seem that this should be extremely difficult of accomplishment. But when we stop to consider that ordinary watches beat five times per second—three hundred times per minute—eighteen thousand times an hour—and 432,000 times per day! without stops! and that an error of the one-thousandth part of each of those vibrations would amount to about ninety seconds in twenty four hours, it really begins to appear something of a task to compass all the needs of that little busy balance, and its delicate partner, the thread-like coil that is in such constant motion, back and forth, during minutes, days, weeks, years, with such patient, plodding regularity. What are the necessary qualifications in the substitute metal? It must be non-magnetic. It must be of a non-oxidable character—must not rust. It must be as permanently elastic as steel. It must be capable of adjustment for heat and cold.

Mr. Paillard for a long period was, to all appearances, battling with fate, as no simple metal possessed all the necessary qualifications. Metals possessed of one necessary peculiarity were lacking in one or more equally important particulars, and it was not until that patient experimen'er had hit upon his present alloy that perfect success crowned his hopes and endeavors.

Mr. Paillard informs us that not until he had experimented for some fourteen years did he arrive at a satisfactory substitute for the metals ordinarily used for balances and springs.

The most satisfactory result was at last reached. Mr. Paillard produced an alloy of palladium, which fully met all requirements. Palladium is a metal only known since 1803, when it was discovered by Wollaston. It weighs a trifle more than half as much as gold; the alloy having a specific gravity of 8.5, while that of steel is 7.7.

In the formation of the balance Mr. Paillard accomplished the compensation by the use of two different alloys of palladium, having unlike co-efficients of expansion. This enabled him to more thoroughly unite the two portions of the balance, as a weld is far more perfect between sections of the same metal than between those of dissimilar metals.

The claims of Mr. Paillard seem well authenticated, and are endorsed by competent authority, such for instance as a silver medal and favorable report of the jury at the National Exhibition of watch-making at Besançon, France; Haswel, the sea chronometer constructor, of London, Leroy, of Paris, and Kullberg, of London, all of whom endorse the non-magnetic chronometers of this manufacture. American scientists are also found among the endorsers of this movement. Watches embracing these peculiarities are manufactured and handled exclusively by the Geneva non-magnetic watch company, and are so thoroughly devoid of magnetic affinity that they may be placed on the strongest electric light dynamo, without in the least affecting their rate of movement.

The future endorsing the past, Mr. P. will certainly have conferred upon the railroad fraternity, as well as the rest of humanity, a great and priceless boon.

A New Electric Lamp.

A lamp has been on exhibition in a committee room of the House of Commons, which, I hear, is to be used in mines, railroad carriages and omnibuses. It consists of a small portable battery. The lamp shown was calculated to burn, with a light of two and a half candles, 12 hours, at a cost of one penny, and the zinc plate which would cost a penny, would have to be changed every 25 days. I asked the exhibitor whether he had lamps which would be suitable for rooms. He said, yes; that they had one of five candle power, which would cost 2d. per charge, lasting 18 hours. If these figures are verified by experience, I should think that these lamps would be universally adopted, provided that the patentee does not charge an excessive price for them.—*London Truth.*

.... The passing of the B & O. Ry. dividend compels quite a retrenchment on the part of the city of Baltimore, which is a large holder of the stock, and will probably result in quite a reduction of the electric lighting contract.

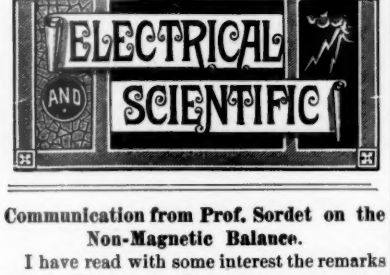
.... Lincoln, Neb., is to have an electric street railway. Mr. John H. Ames, of the Lincoln Cable Company, is at the head of the motor company.

TELEGRAPHIC

.... Mr. Christopher Dougherty, manager of the Postal lines at St. Louis, states that he believes that they had received fully from one-third to two-thirds of the Baltimore and Ohio trade. They intend to keep to the low rates, and expect to largely increase their force, both in branch and main offices. The people, he thought, failed to recognize the fact that while the Baltimore and Ohio covered only 40,000 miles, the Postal, with the lines with which it was virtually affiliated, extended over fully 60,000 miles.

... General Manager Hall's testimony before the legislative investigating committee at Buffalo brought out the fact that the company operates in seven counties, comprising some 21 different stations. The scale of prices charged for telephone services in Buffalo was next submitted. No exceptions are made to customers, save to railroad and newspaper offices and charitable institutions. The company employs the flat rate in the country towns and the toll system in Rochester and Buffalo. When asked the reason why, Mr. Hall replied, because it was not profitable. Mr. Hall explained the system of charging for messages. A block of tickets is before each operator, and whenever a call is made the operator puts down on a ticket the number of the caller and party called. When the connection cannot be made the operator crosses the ticket. These tickets, crossed or not, are collected every hour, sorted by employes retained for that purpose, and charged to each subscriber. Postal cards are mailed to the subscribers monthly, stating how the accounts stand, and affording an opportunity to make corrections, if such be necessary. Mr. Hall's testimony showed that the company was given permission to erect poles and street wire by the city, in consideration for affording free transit for wires used for municipal purposes.

..... Dr. Karsten, writing in the *Electrotechnische Zeitschrift*, describes an instrument under the name of the telephone siren, which consists of a disk on which a number of magnets are arranged radially with their similar poles adjacent. By means of a clockwork driven by weights this disk is made to revolve in front of a fixed iron core upon which a coil of wire is wound. A telephone receiver is placed in connection with this coil, and on rotating the disc the induced currents set up a clear and distinct note in the receiver. The pitch of the note may obviously be changed either by altering the speed of rotation or by varying the number or the arrangement of the magnets. If the inner poles are arranged N, N, N, etc., a certain note is produced at a certain speed; with the arrangement N, S, N, S, etc., the note is an octave lower; with the arrangement N, N, S, N, N, S, three tones are simultaneously heard. The highest of these is given as being the same as in the first arrangement, the next is an octave deeper, and the lowest is a fourth of this octave. When a sufficiently powerful motor is used to revolve the disk, tones of equal loudness throughout can be produced, and when compared with those emitted by other instruments the well-known beats are clearly audible. The telephone siren can therefore be used to determine the vibration-frequency of any note, as well as to prove the principle of interference caused by vibrations whose wave lengths are opposite in phase. The instrument is also applicable to the telephonic determination of electrical resistances in which equality of resistances in a Wheatstone bridge is detected by an absence of sound in the telephone. This mode of testing is often rendered uncertain by extraneous disturbing sounds, but the clearness of tone of the telephone siren can always be distinguished from superposed sounds from other sources.



Communication from Prof. Sordet on the Non-Magnetic Balance.

I have read with some interest the remarks of "Cosmic" and "Tricotrin" on the effect of magnetism in watches and marine chronometers which have appeared from time to time in various horological journals of America.

As I have spent much time and labor during the past few years in laborious experiments with magnetized time-pieces and cures for the same, the result of my experiments may be of some considerable interest to the watchmakers of America, where, perhaps, the evils of magnetism are more severely felt than in any other part of the world.

The communications from "Cosmic" and "Tricotrin" show some knowledge of the question of magnetized time-pieces, but it seems to me that both have yet something to learn upon the subject. Mr. "Cosmic" evidently has an interest in a certain anti-magnetic shield which he is very desirous of making the public believe is the only cure for magnetized time-pieces. Mr. "Tricotrin" goes nearer to the root of the evil, and advocates making the balance, escapement, and hair-spring of the watch of non-magnetic metals.

As I have invented a machine for demagnetizing watches, in order to feather my own nest I should advocate demagnetizing the watch as the sole and only remedy. But there are times when one's own selfish interests must be laid aside, so as that the greatest number of mankind may be benefited thereby. No man should endeavor to put his own selfish interests in the way of a great advancement in science. There are times when the truth should be told, even though it costs our pockets francs.

Just why the American watchmakers should be running after an invention of so little merit as an iron box around a watch to keep magnetism away, when by using the palladium hair-spring and Paillard's new non-magnetic compensation balance, the evil is at once eradicated completely, is an inexplicable mystery to me. Why the American watch-owner wants to carry around a clumsy mass of base metal in his pocket instead of a neat, commodious time-piece, is something I cannot understand. We have always heard that America was the land of inventions and of progress, and that the American watchmaker was far in advance of the balance of the world in machinery, interchangeable watch parts, and so forth. We have been frequently reminded that the Swiss were old-fogy, and behind the age.

In view of these assertions we have a right to expect that an invention of real merit and an actual step forward in the science of horology, like the Paillard non-magnetic compensation balance and spring, would at once be adopted by America, the land of all others that will be benefited by the long labors and hard-earned inventions of Mr. C. A. Paillard; yet we see statements that the United States Government is about to put iron boxes around its marine chronometers, and why? To make the chronometer impervious to magnetism; to keep inside the steel spring constantly exposed to rust and corrosion, when by simply substituting the Paillard balance and spring for the present steel and brass balance and steel spring, not only are the evils of magnetism completely eradicated, but the evils of rusting and corrosion are also overcome; and what is more, a better and more accurate adjustment in temperatures is secured than can be produced with steel adjusting mechanism. I have been led to believe that had the Paillard balance been an American invention we should never have heard of anti-magnetic shields, but as Mr. Paillard has the good fortune to be a Genevese adjuster of known repute, his inventions seem to have incurred the jealous feelings of certain American watchmakers, who seem to be trying to force an inferior device upon their countrymen in order to kill the invention of Mr. Paillard.

Inventions, as well as persons of great merit, usually incur great opposition and enmity from those of lesser importance; in fact, the greater the merit of the invention, the greater the enmity incurred. The great utility and scientific as well as practical value of the Paillard inventions seem to have produced the bitterest enmities, and this is of itself the best and most convincing proof of the real value of the invention.

Just how long the advocates of adulterating watch-cases with base metals, in order to protect the watch from magnetism, can lead the American public astray, remains to be seen, especially when the watch movement itself can be made magnet-proof without any extra cost or increase of bulk in the watch; but it occurs to me that the American watch manufacturer and watch dealer will confer more benefit upon their countrymen by manufacturing non-magnetic watch movements than by adulterating their watch-cases with base metals, and will probably reap more benefits in the end.

Watches are magnetized in hundreds of ways of which no man knows; approaching a dynamo or a small magnet of any form (such as a horseshoe magnet), or magnets in the telephone receivers or transmitters, are all fatal to watches. Electric motors, such as used on street railways, are particularly destructive to time-pieces, and the general introduction of electric motors in large cities must be followed by the adoption of non-magnetic watches. Putting a magnetized knife in the pocket alongside of a watch is fatal, and handling the balance-spring or parts of the escapement with a pair or magnetized tweezers produces magnetism to such an extent as to destroy the accurate rate of the watch. Ladies' steel corset-springs become magnetized and ruin their watches, and severe electrical storms magnetize the hair-springs and destroy numbers of watches.

If the balance and hair-spring of a watch are non-magnetic, I have found that saturating the watch with magnetism has no deleterious effect.

Again, if the escapement as well as balance and spring is made of non-magnetic metals, the watch may be placed on the poles of the most powerful dynamo without stopping it or producing any evil effect. With a steel escapement and non-magnetic balance and spring, placing the watch between the poles of very strong magnets, so that the magnetic current passes directly through the escapement, causes the watch to stop, but by moving the watch so that the escapement is not in the direct current, the watch immediately resumes its rate.

My experiments with the Paillard non-magnetic watch have proved conclusively that it overcomes all the difficulties arising from magnetism in watches.

Now, let me ask "Cosmic" if putting an "anti-magnetic shield" around a watch is the only way to protect it against magnetism? "Cosmic's" anti-magnetic shield does not behave so well under tests as I had been led to believe from the grand claims its promotors have made for it. I procured one of these anti-magnetic watches and proceeded to test it, approaching it to within a few inches of the poles of my demagnetizing machine, stopping it at once, thus proving the utter fallacy of the claim that it is a perfect protection against magnetism.

Again, I magnetized the escapement alone and placed the movement inside the case, and found that the watch showed great variation in its rate on account of the magnetized escapement. I found the anti-magnetic shield to be of some value in protecting the movement in light currents, but as soon as the volume of the magnetic current was sufficiently strong to saturate the shield, the watch became at once magnetized. The results of my experiments convinced me of the superiority of Paillard's non-magnetic compensation balance and palladium hair-spring over any other invention which I have seen to overcome the magnetic influence upon watches, and yet retain the essential qualities for accurate adjustments to changes of temperature, and I may further add that it is the only invention that I am aware of that *absolutely* overcomes the evils of magnetism in watches.

Very truly yours,

E'RD SORDET,

Director of the Horological School of Geneva, Switzerland.

Edison's Perfected Phonograph—His New Laboratory Nearly Completed—Other Electrical Work.

In the suburbs of the city of Orange, New Jersey, Thomas A. Edison is now building what promises to be the most perfect physical and chemical experimental laboratory in the world, which has been heretofore mentioned in the ELECTRICAL REVIEW. His laboratory at Menlo Park long ago grew too restricted for the needs of the large number of expert workmen whom he keeps constantly employed in carrying out the suggestions which he makes to them. For years he has wished to build such a laboratory as he is now finishing, and he confesses that this use of money is that which has given him the most pleasure of recent years. The new laboratory buildings are within sight of the pleasant country house which Mr. Pedder, the former cashier of Messrs. Arnold & Constable, built at great expense, and which Mr. Edison bought last year from that firm. The main buildings consist of three separate structures, each one about 100 feet long by 50 feet wide, four stories high, and built of brick in the most substantial manner. Mr. Edison hopes to begin work in them some time this month. They are supplied with every device for experimental work which the scientific mind can imagine. The buildings will be heated by steam and lighted by electricity.

Steam power will be supplied to all the machinery; a dozen separate laboratories will be fitted up with every known apparatus for experimental work in physics or chemistry, and scores of experts, brought from all parts of the world, will stand ready to place their knowledge at Edison's disposal.

In the materials with which the storerooms are to be stocked, there have been thousands and thousands of dollars spent, and if Mr. Edison does not have every needful article used in his science, it will not be the fault of his assistants. He has given directions to go through half-a-dozen works on chemistry, physics, and mechanics, and make a list of every article specified. For instance, in turning over Watt's Chemistry one comes across materials at every page never heard of outside of the most complete chemical laboratories; all these Mr. Edison must have if money can obtain them. He will have every kind of iron and steel, every kind of known wood, every kind of glass, every metal in all their different shapes, every stone, every variety of clay, chalk, every vegetable substance that may be of use, from the first of the Arctic regions to the giant grasses of the Amazon. Half-a-dozen times in Edison's life his work has been brought to a standstill by the lack of some material known to exist, but which could not be obtained without long delay and great cost. He had to send to Japan to get the bamboo fiber used for the carbons for his lamps. At present, so he informs an *Evening Post* reporter, he is interrupted in his work upon the apparatus for generating electricity directly from heat, by the impossibility of finding nickel in sufficient quantities in this country; he has cabled to England, and has had to suspend operations until the material arrives. At any moment he may require some almost unheard-of material, and he aims by this wonderful collection, the list of which already reaches 8,000 items, to provide against annoying delays.

On being interviewed recently in the laboratory of his lamp factory in Newark, from which 4,000 lamps a day are now sent out, Mr. Edison said that the commercial phonograph is now the most interesting thing in the world to him, although it is perfectly finished, and tools are being made for its manufacture upon a large scale.

The stories which Mr. Edison tells of what his perfected phonograph will do are so extraordinary that he scarcely expects people to believe him, and yet he says that the apparatus is so simple, so effective, and so immediately useful, that he is certain of its rapid introduction into business—far more certain than he was of the universal adoption of the telephone as a business instrument.

Mr. Edison said of his newly finished phonograph: "You know that I finished the first phonograph more than ten years ago It remained more or less of a toy. The germ of something wonderful was perfectly distinct, but I tried the impossible with it, and when the electric light business assumed commercial importance, I threw everything overboard for that. Nevertheless, the phonograph has been more or less constantly in my mind ever since. When resting from prolonged work upon the light, my brain would revert almost automatically to the old idea. Since the light has been finished, I have taken up the phonograph, and after eight months of steady work, have made it a commercial invention. My phonograph I expect to see in every business office. The first 500 will, I hope, be ready for distribution about the end of January. Their operation is simplicity itself, and cannot fail. The merchant or clerk who wishes to send a letter has only to set the machine in motion, and talk in his natural voice and at the usual rate of speed into the receiver. When he has finished, the sheet, or 'phonogram," as I call it, is ready for putting into a little box made on purpose for the mails. We are making the sheets in three sizes—one for letters of from 800 to 1,000 words, another size for 2,000 words, another size for 4,000 words. I expect that an arrangement may be made with the post-office authorities enabling the phonogram boxes to be sent at the same rate as a letter.

"The receiver of a phonogram will put it into his apparatus and the message will be given out more clearly, more distinctly than the best telephone message ever sent. The ones of the voice in the two phonographs which I have finished are so perfectly rendered that one can distinguish between twenty different persons, each one of whom has said a few words. One tremendous advantage is that the letter may be repeated a thousand times if necessary. The phonogram does not wear out by use; moreover, it may be filed away for a hundred years and be ready the instant it is needed. If a man dictates his will to the phonograph, there will be no disputing the authenticity of the document with those who knew the tones of his voice in life. The cost of making the phonogram will be scarcely more than the cost of ordinary letter paper. The machine will read out the letter or message at the same speed with which it was dictated.

"I have experimented with a device for enabling printers to set type directly from the dictation of the phonograph, and think that it will work to a charm. It is so arranged that the printer, by touching a lever with his foot, allows five or ten words of the phonogram to be sounded; if he is not satisfied with the first hearing, he can make it repeat the same words, over and over again, until he has them in type. For busy men, who dictate a great deal for the press, I am sure that the phonograph will be a necessity after a very little experience.

"For musicians the phonograph is going to do wonders, owing to the extreme cheapness with which I can duplicate phonograms and the delicacy with which the apparatus gives out all musical sounds. In the early phonograph of ten years ago, which was a very imperfect and crude affair, compared with that of to-day, it was always noticed that musical sounds came out peculiarly well; the machine would whistle or sing far better than it would talk. This peculiarity of the phonograph remains. I have taken down the music of an orchestra, and the result is marvelous; each instrument can be perfectly distinguished; the strings are perfectly distinct, the violins from the cellos, the wind instruments and the wood are perfectly heard, and even in the notes of a violin the over-tones are distinct to a delicate ear. It is going to work wonders for the benefit of music lovers. A piece for any instrument—for the piano, or for an orchestra, or an act or the whole of an opera—musical instruments and voices can be given out by the phonograph with a beauty of tone and a distinctness past belief; and the duplicating apparatus for phonograms is so cheap an affair that the price of music for the phonograph will be scarcely worth considering. As the phonogram will be practically indestructible by ordinary use,

such music can be played over and over again.

"My first phonograph, as you remember, consisted simply of a roller carrying the foil, and provided with a diaphragm-point properly arranged to scrape or indent the foil. The roller was turned by hand. In the new instrument there is far more complication, but altogether different results. My propelling machinery consists of a small electric motor, run by a very few cells. Strange to say, I have found more difficulty in getting a motor to suit me than any other part of the apparatus. I tried various kinds of clockwork and spring motors, but found them untrustworthy and noisy. The motors I am now making are absolutely steady and noiseless. There is no part of the apparatus—the tools for which I am now making upon a large scale here—which is likely to get out of order or to work in an uncertain manner."

Among the things at which Mr. Edison is hard at work, taking them up in turns, are the cotton-picker, the heat-generator of electricity, and a new device for propelling street cars by electricity. As already mentioned, the heat generator has been brought to a standstill by the lack of nickel in this country. Edison found that the rapid heating and cooling of iron plates in his generator, which was described at length in the ELECTRICAL REVIEW at the time of the September meeting of the American Association for the Advancement of Science, caused them to disintegrate very rapidly. Nickel does not attain so high a degree of magnetization as iron, but it loses it more rapidly under the action of heat, and Edison expects better results from it than from iron. The cotton picker upon which he is at work is the result of an idea which came to him down in Florida last winter. He is not quite sure that it will result in a practical cotton-picker, but he has faith enough in it to make the experiments. He will not yet say in what consists the essential feature of his proposed machine. The last work which he proposes to undertake very soon is to run the Orange street-cars upon an electric system which he says will not need any overhead wires or underground conduits—both expensive and troublesome necessities of all existing electric railways. He is confident that he can do this, and is now busy upon the first working models.

—— St. Joseph, Mo., has organized an Electric Club.

—— Utica, N.Y., is endeavoring to reduce electric light rates.

—— Chicago is much pleased over the prospect of having all its extensive river front lighted by electricity.

—— Lightning struck the electric light works at Silver City, and the dial was melted. The works will have to close down until a new dial can be obtained.

—— The city council of Superior, Neb., has granted to Frank Everest and associates the exclusive right and privilege, for 25 years, to erect and maintain a system of electric lights, and to furnish light to the city, provided work shall begin on or before July 1, 1888, and shall be completed on or before October 1, 1888.

—— Cowles Electric Smelting and Aluminum Company, of Lockport, N. Y., whose iron aluminum alloys are now in general use by our steel works in making steel castings, has recently received from Germany an order for five tons of ten per cent. aluminum iron containing about 1,000 pounds of aluminum.

—— How is this, from a Buffalo daily: "To the most casual observer and the most careless of our citizens it must be apparent that Buffalo is rapidly drifting into a position where it will very shortly be completely in the power and subject to the will of the corporations who are now fattening at the public crib, and who are sucking the life-blood from this municipality and its private citizens alike. Foremost among these rapacious corporations are the gas and electric light companies of our city." Can't Bro. Frear remedy this sad state of affairs?

The Clark Arc Lamp.

The arc lamps of the Clark Electric Co., New York, are of an entirely new design, the mechanism containing no clutches, solenoids, dash pots, nor glycerine. The feeding of the positive carbon is effected by means of a small electro-motor contained in the lamp case, and having on its shaft a small pinion gearing directly into the rack teeth of the rod; these teeth are cut directly in the rod itself, and not in a separate piece which is afterwards soldered to the rod, and which has been one cause of the failure of geared lamps as usually constructed. The motor which regulates the feeding of the carbons is a simple affair consisting of a small Gramme armature revolving between the poles of an electro-magnet. The magnet has two coils of wire wound upon it, one in the main circuit, which induces powerful magnetism in the magnet and tends to cause the armature to revolve, lifting the upper carbon and striking the arc. The second coil is of very

THE CLARK ARC LAMP.

fine wire, and is so wound and connected that it allows a very small portion of the current to pass through it without passing through the carbons.

Its magnetic effect is the opposite to that of the first coil, and tends to weaken the power of the magnetism in the field magnet, allowing the armature to turn backward and the rod with the upper carbon to descend. If the arc is too short the coil of coarse wire strengthens the electro-magnet, and the armature revolves and the arc is lengthened; if too long, more current is sent through the fine wire, the magnet is weakened and the arc is shortened. Thus it will be seen that the lamp is really a delicate electrical balance, responding instantly to and correcting any variation of the length of the arc.

If the rod of this lamp should stick, through neglect of cleaning, the arc will gradually become longer, more current will pass through the fine wire coil, and finally this coil will completely overcome the effect of the other one and reverse the polarity of the electro-magnet, causing the armature to revolve backward and force the rod past any slight obstacle, after which the normal action is resumed; if, however, the obstacle is anything serious and is beyond the power of the motor to overcome, the automatic cut-out will then operate and the carbons will then be cut out of circuit and will remain so until the lamp is attended to.

This lamp is used with the Clark dynamo, illustrated and described in the REVIEW several months ago.

—— There is a demand for an electric pile driver.

—— The city council of Cherryvale, Kas., has granted a franchise for electric lights.

—— Columbus, Ga., is to have an electric light plant. Mr. T. E. Blanchard is interested.

—— Chattanooga, Tenn., has ordered a number of Brush electric lights at $10 each per month.

——An electric street railway is being constructed at Richmond, Va., and eleven miles of track have been laid.

—— Butte, Montana, is asking for additional electric lamps in its streets. Part of the city only is lighted, as yet.

—— J. H. Woolsey, of the United States Electric Light company, of St. Paul, will erect a light plant at St. Cloud, Minn.

—— The Electric Light and Patent Flooring Company of Amesbury, Mass., is to commence work at once upon an additional new building.

—— The Knoxville, Tenn., city council has directed the Mayor to annul the contract with the Knoxville Gas Company and obtain electric street-lamps.

—— J. H. Woolsey, of the U. S. Electric Light Company, of St. Paul, Minn., has made arrangements to establish an electric light plant in St. Cloud, Minn.

—— The Fremont Electric Light and Power Company, Fremont, Ohio, has been incorporated. Capital stock, $20,000. D. A. Rauck and others incorporators.

—— The Battle Creek Electric Light and Power Company, Battle Creek, Mich., has been incorporated. Capital stock, $100,000. W. A. Foot and others incorporators.

—— Mr. W. A. Jackson, managing director of the Michigan Telephone Company, and the head of the Detroit Electrical Works, was a New York visitor the past week.

—— The Middlesex Electric Light Company of Lowell, Mass., has commenced the erection of a two story block directly adjoining its present building, 25x82 feet.

—— The Thomson-Houston Electric Company of Boston has received an order from the city of Amsterdam, N. Y., for an arc lighting plant of 100 lamps to be operated by the local company using the Edison system of incandescent lighting.

—— The connecting rod of the engine at the electric light works in Omaha was broken one evening last week, and as a result of the flying pieces the engine was entirely wrecked. The electric lights had to be dispensed with until a new engine could be set up.

—— The Brush Electric Company, Cleveland, Ohio, has issued an interesting little pamphlet entitled "Electric Light for the Public Streets," in which is given the opinion of the police officers from all parts of the country, all of them strongly favoring the electric light for use in cities as a protection to life and property.

—— New Albany, Ind., is certain to have electric lights at no distant day. At the meeting of the council, a week ago, a company accepted an ordinance granting them the right of way to maintain a plant. Now comes the New Albany Gas light and Coke company and propose to establish a plant in connection with the glass works. The company will ask for right of way at the next meeting of the council.

—— Many of the supplies for the electric light plant at Council Bluffs, Iowa, have been received, and are being put up in place as rapidly as possible. The dynamo and the second engine have not as yet reached Council Bluffs. The supply of the city will consist of twenty-eight lights, four of which will remain in the present position on the court house. The other twenty four will be placed on six towers, at least 150 feet high, scattered throughout the city. It is not feared that the light will be interfered with, except possibly when the new dynamo is placed in position.

ELECTRIC LIGHT NEWS

—— The struggle for supremacy between electricity and gas for lighting purposes in Minneapolis, Minn., is very close.

—— The Brush Electric Light Company, Rochester, G. A. Redman, superintendent, has 1,000 arc lamps in circuit. This is good work.

—— The Pike Electric Light Company, of East St. Louis, has been incorporated, with a capital stock of $25,000. Edward W. Pike, N. Oscar Gray and Sherman B. Pike are the incorporators.

—— The thread works of W. Warren, at Westfield, Mass., make a specialty of threads for covering wires for electrical purposes. The manufacture of polished and dressed threads is carried on very extensively in the new field of electrical work. These thread works are meeting with much success.

—— Salina, Kas., is discussing the feasibility of supplanting the greater part of its gas light system with electric lights. The citizens have petitioned the council to have it done and the council has appointed a committee to arrange for the location of twelve or more arc lights of 2,000 candle power each, to be contracted for one year.

—— The Emporia, Kas., Gas and Electric Light Company has decided to erect an electric plant on its own property on Third avenue and Mechanic street. The work will begin at once, and when completed, will enable the company to furnish more arc lights of the Brush patent, for lighting the streets, and also incandescent lights for stores and dwellings.

—— The Newton Electric Light and Power Company, Newtonville, Mass., has ordered the third Armington & Sims Company engine, from the Jarvis Engineering Company, 61 Oliver street, Boston, to run the Thomson Houston Company alternating system of incandescent lights. It is lighting the streets of Watertown successfully with this system.

—— Bunnell's Grand Opera House, of New Haven, is lighted throughout by incandescence, 350 lamps of 16 candle power being used. The lights, which are of the Thomson-Houston system, are furnished by the New Haven Electric Company. The manner in which the wiring has been done, and the arrangement for increasing or diminishing the lights, reflect credit upon Mr. Fred Lewis, who had charge of the installation.

—— The Bureau of Printing and Engraving, at Washington, D. C., is to be lighted with incandescent light throughout. Edison system will be used, and the buildings are now being wired. The installation will consist of 1,000 lamps of 16 candle power. The contract is being carried out by the U. S. Electric Lighting Co. of Washington D. C., who will furnish the current from their main station, about 1,200 feet distant, and rent the light to the bureau at the same rate as now paid for gas.

—— The Silvey Electric Company has been organized at Lima, Ohio. The officers are: President, B. C. Faurot; vice president, George D. Ryder; secretary, F. P. Graf; treasurer, F. L. Langan; electrician and general manager, W. L. Silvey. The board of directors consists of the above officers and George Feliz and D. J. Cable. The stockholders include, besides the above, William Graver, of Englewood, Ill.; L. E. Osborn, of Bradford, Pa.; Howard Strong, of Olean, N. Y.; B. C. Colwell, of Portville, N. Y.; E. G. Atkinson, of Waynesfield, O., and George Fetter, of Lima. The Silvey headlight for locomotives and other electrical appliances will be manufactured.

ELECTRICAL PATENTS

INDEX OF INVENTIONS FOR WHICH LETTERS PATENT OF THE UNITED STATES WERE GRANTED IN THE WEEK ENDING OCT. 25, 1887.

371,915 Governor for incandescent lights on arc circuits; Chauncey D. Baker, Chicago, Ills.

371,936 Electric railway; 371,937 Rheostat; John Hartmann, Jr., Philadelphia, Pa.

371,940 Electrical communicating system; Alfred G. Holcombe, New York, N. Y.

371,948 Electric current indicator; Wyllis H. Mackland, Altoona, Pa.

371,965 Hauling through conduit system; James F. Music, Chicago, Ills.

371,980 Automatic and autographic telegraphy; Charles Selden, Baltimore, Md., assignor of one-half to William C. Barnard, same place.

372,012 Electrical resistance board; Irving W. Curwin, Fitchburg, Mass., assignor to Hanson, Van Winkle & Co., Newark, N. J.

372,026 Electrical safe lock; 372,027 Electro-magnetic safe lock; 372,028 Electrical safe lock; 372,029 Electrical combination lock; Charles J. Kintner, Philadelphia, Pa.

372,046 Electrical primer; George Stuart, Elswick works, Newcastle-upon-Tyne, England, assignor to W. G. Armstrong, Mitchell & Co. (Limited), same place.

372,058 Underground electric conductor; Henry Metzger, Pittsburgh, Pa.

372,155 Telegraph key and sounder; George M. Lane, Asbury Park, N. J.

372,167 Fire-extinguishing apparatus; William Neracher, Cleveland, Ohio.

372,168 Compensated induction coil; William Oliver, London, England, assignor to Messrs. Daniel Judson & Son (Limited), same place.

372,193 Galvanic battery; James T. Armstrong, London, England.

372,201 Regulator for dynamo electric machines; Charles E. L. Brown, Zurich, assignor to the Werkzeugmaschinenfabrik Oerlikon, Oerlikon, near Zurich, Switzerland.

372,208 Electric valve controller; Simpson W. Dermott and Wesley V. Dermott, Pittsburgh, Pa.

372,231 Regulator for electric motors; Alexander W. Meston, St. Louis, Mo., assignor of one-half to J. H. Clark, same place.

372,245 Autographic telegraphy; John E. Watson, Louisville, Ky., assignor to the International Electric Company, same place.

372,277 Call register for telephones; Arthur F. Adams, Little Rock, Ark.

PATENTS.

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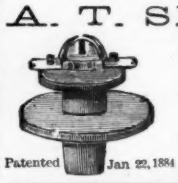

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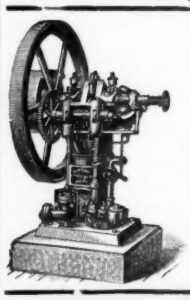

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